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# REMEDIAL SITE ASSESSMENT DECISION - EPA NEW ENGLAND

Site Name: Cranston Sanitary Landfill EPA ID#: RID084812577

Address: 1688 Pontiac Avenue City: Cranston State: RI

Refer to Report Dated: 04/18/95 Report type: Expanded Site Inspection (ESI)

Report developed by: RIDEM

Superfund Records Center

SITE: Cranston Sanitary

PROJECT: 1.3

FILE NO: 583972



SDMS DocID 583972

## DECISION:

| | 1. Further Remedial Site Assessment under CERCLA (Superfund) is not required because:

| | 1a. Site does not qualify for further remedial  
site assessment under CERCLA  
(No Further Remedial Action Planned - NFRAP)

| | 1b. Site may qualify for further  
action, but is deferred to:

| | RCRA  
| | NRC

|X| 2. Further Assessment Needed Under CERCLA:

2a. (optional) Priority: | | Higher |X| Lower

2b. Activity | | PA | | ESI  
Type: | | SI |X| HRS evaluation

| | Other: \_\_\_\_\_

## DISCUSSION/RATIONALE:

Documented releases to groundwater and surface water.

Report Reviewed  
and Approved by:

Sharon M. Hayes Signature: [Signature] Date: 08/29/96

Site Decision  
Made by:

Sharon M. Hayes Signature: [Signature] Date: 08/29/96

**DRAFT EXPANDED SITE INSPECTION REPORT  
FOR  
CRANSTON SANITARY LANDFILL  
CRANSTON, RHODE ISLAND**

**CERCLIS No. RID084812577**

**PREPARED BY:  
RHODE ISLAND DEPARTMENT OF ENVIRONMENTAL MANAGEMENT  
DIVISION OF SITE REMEDIATION**

**April 18, 1995**

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## **1. INTRODUCTION**

The Rhode Island Department of Environmental Management (RIDEM), Division of Site Remediation (DSR) team was requested by the Region I U.S. Environmental Protection Agency (EPA) to perform an Expanded Site Inspection (ESI) of the Cranston Sanitary Landfill (also known as Sanitary Landfill, Inc., and hereafter referred to as CSL) property in Cranston, Rhode Island. Tasks were conducted in accordance with a Multi-Site Cooperative Agreement between RIDEM and EPA and with technical specifications provided by EPA.

A Preliminary Assessment (PA) and a Site Inspection (SI) were completed by EPA on 15 March 1982 and 1 May 1982 respectively. Based on the information provided in the PA and SI reports, the Cranston Sanitary Landfill ESI was initiated. The ESI is an interim step in the Superfund Site Assessment program; it is intended to update the information known about a site to current program standards.

Background information used in the generation of this report was obtained through file searches conducted at the Rhode Island Department of Environmental Management (RIDEM), telephone interviews with town officials, conversations with people knowledgeable about the CSL property and conversations with other federal, state, and local agencies.

This package follows the guidelines developed under the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended, commonly referred to as Superfund. However, these documents do not necessarily fulfill the requirements of other EPA regulations such as those under the Resource Conservation and Recovery Act (RCRA) or other federal, state, or local regulations. ESIs are intended to provide a final screening of sites to facilitate EPA's assignment of site priorities.

## **2. SITE DESCRIPTION**

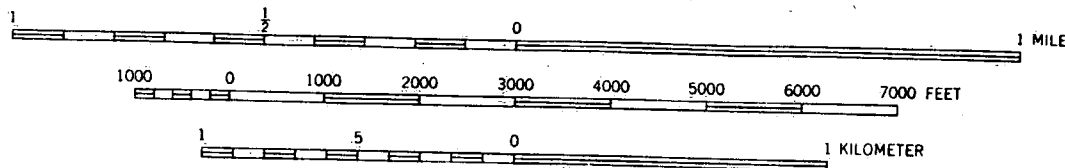
The Cranston Sanitary Landfill (CSL) site (latitude 41° 44' 7.42", longitude 71° 27' 33.69") is located east of Pontiac Avenue, in the City of Cranston, Rhode Island (Figure 1). The site is located on a lot comprising approximately 47 acres, presently occupied by one commercial building surrounded by a paved area and an inactive landfill. A presently active transfer station, operated by Waste Management, Inc., is located on the property on which the site is located (Chatterton, 1994d).

As of May, 1994, the records of the Cranston Tax Assessor's Office indicate the ownership of the lot that the site occupies as plat 13, lot 1, owned by Capuano Associates. Town records show the history of the ownership of plat 13, lot 1 as follows:



NOTE: The nearest well was assumed to be approximately 1.5 miles from the site. The exact location of this well was not established.

Modified from 7.5 minute USGS Topographic Maps listed below:  
East Greenwich and Providence 1957 Photorevised 1970 and 1975  
Scale 1 : 24,000



LOCATION MAP: FIGURE 1  
CRANSTON SANITARY LANDFILL  
CRANSTON, RI

STATE OF RHODE ISLAND  
DEPARTMENT OF ENVIRONMENTAL  
MANAGEMENT

DATE      OWNER

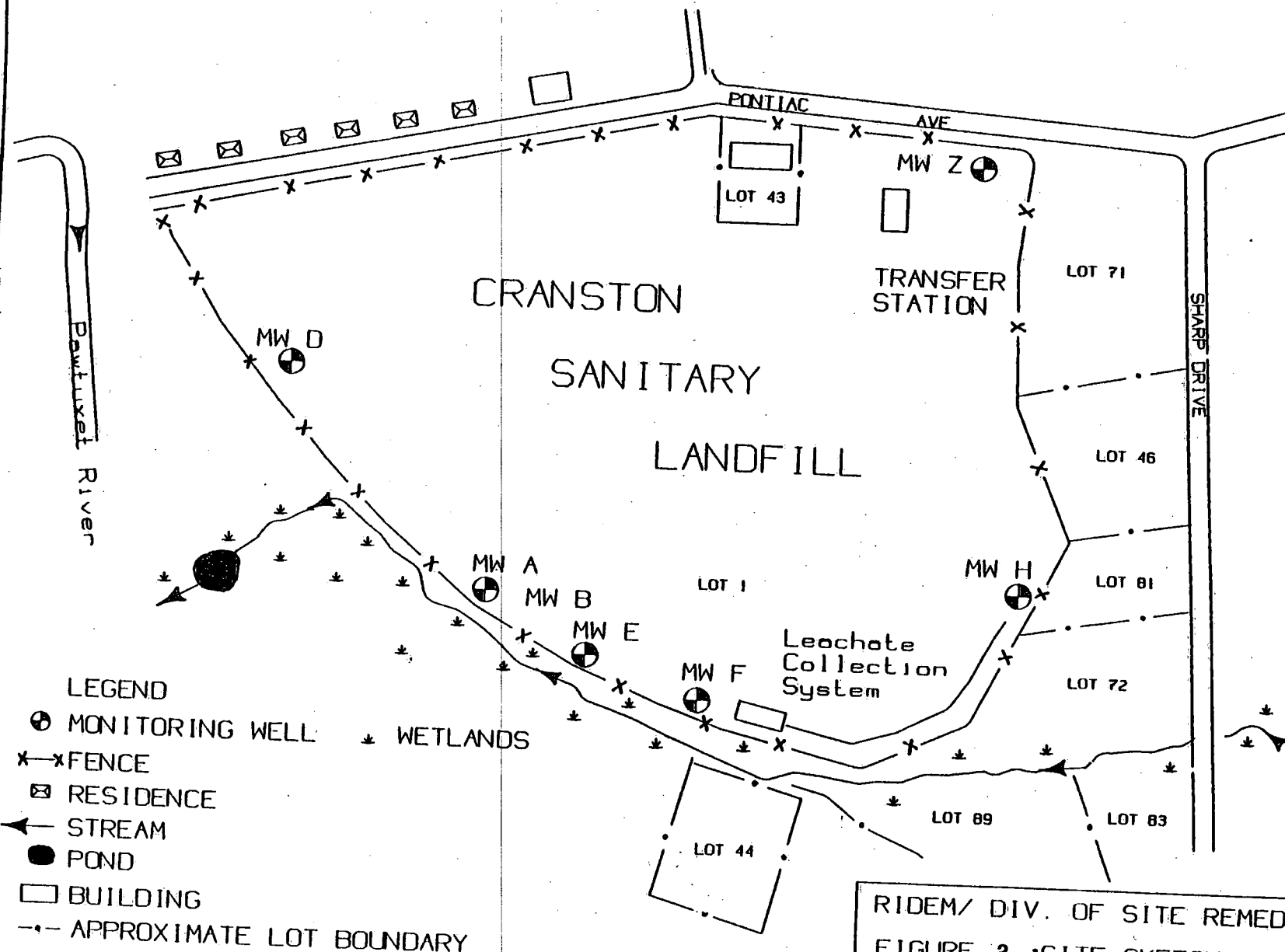
6/15/37    Slade, George A.  
6/21/45    Capuano, Daniel & wife Angelina (Jt ten)  
3/20/73    Capuano, Daniel & wife Angelina (Jt ten) (area decreased)  
6/23/73    Capuano, Angelina Estate  
2/17/77    Capuano, Angelina Estate  
1/12/78    Capuano, Anthony, Daniel Capuano Jr. & Jack Capuano  
8/15/84    Capuano, Anthony, Daniel Capuano Jr. & Jack Capuano  
1/22/86    Capuano, Anthony Est., Daniel Jr. & Jack  
4/19/93    Capuano Associates

(Chatterton, 1994e)

Access to the site is restricted by a locked fence, and vehicular access is available via Pontiac Avenue, which is a paved road to the west of the property. A dirt road is located along the toe of the landfill allowing for vehicular access for monitoring wells (Chatterton, 1993d). The area of the site is characterized by generally high topographic relief. The maximum thickness of the fill is estimated to be approximately 70-80 feet. The property is occupied by a transfer station, a building surrounded by a paved area, the landfill of approximately 40 acres in extent, and a dirt road that runs along the southeastern boundary of the landfill. In 1985 a 20 ml cap was installed as part of the closure operations. A second 20 ml synthetic cap was installed in 1988 after auto-fluff contaminated with polychlorinated biphenyls (PCBs) was discovered at the site. The landfilled area is presently covered with a grass vegetative cover. This cover, and drainage channels installed in 1990, were designed to minimize erosion of the clean fill that covers the second cap. However, partial erosion of the clean fill can be observed on the faces of the landfill (Chatterton, 1994; Pare, 1990). Figure 2 is a sketch of the site showing some of the relevant features in the vicinity of the landfill. The predominant land uses within a mile of the site are high density residential and commercial (Aerographics, 1988).

The lots abutting the site are occupied by residences to the west, an industrial park to the north and empty wooded lots that occupy the floodplain of the Pawtuxet River to the east and south. The nearest residences are located to the west of the site, along Pontiac Avenue. The distance between these residences and the edge of the landfilled area is approximately 70 feet (Chatterton, 1994d). The majority (98.5%), of the houses within 0.25 miles of the site are served by public water lines (RIGIS, 1991a; USCB, 1990).

Manifests for the disposal of hazardous waste at the site were submitted to the Rhode Island



RIDEM/ DIV. OF SITE REMEDIATION  
FIGURE 2 :SITE SKETCH FOR CRANSTON  
SANITARY LANDFILL

Department of Health (RIDOH) from January of 1978 to October of 1979 (RIDOH, 1978-1979). The disposal of hazardous materials before this period is suspected (RIDOH, 1970-1977). Disposal of hazardous materials at the site is known to have occurred after 1979 (PJB, 1989; RIDEM/DAHM, 22 March, 9 June, 1988). Samples collected from monitoring wells located at the site and sediment samples collected from an unnamed stream adjacent to the landfill indicated the presence of chlorobenzene; benzene; toluene; xylene; dioxane; diisopropyl ether; acetone; isopropyl alcohol; methylisobutyl ketone; dichlorobenzene; trichloroethylene; dichloromethane; methyl ethyl ketone; 1,1 dichloroethane; 1,2 dichloroethane; tetrahydrofuran; benzo(a)anthracene; benzo(k)fluoranthene; chrysene; pyrene; arsenic; barium; cadmium; chromium and selenium at concentrations significantly greater than background (NETL, 1985-1994; ESS, 1993).

### **3. OPERATIONAL HISTORY**

CSL is located on a 47.23 acre lot in Cranston, RI. The landfill began operations in 1943 when it was first documented that it was accepting domestic wastes (EEI, 1982). The landfill began accepting industrial refuse in the 1970's (RIDOH, 1970-1977). The availability of records and information prior to 1970 is limited.

#### **3.1 HAZARDOUS WASTE DISPOSAL**

CSL accepted household refuse throughout its operational period (EEI, 1982). However, in the 1970's the landfill began accepting industrial wastes. In 1978 and 1979 RIDEM required CSL to file manifests of all hazardous material disposed of at the site. Hazardous Waste Disposal Facility Rules and Regulations became effective in part on 21 December, 1978 and in part on 21 June, 1979 (RIDEM/DLR/SWMP, 1979a). In October of 1979 CSL stopped landfilling of hazardous wastes at the site (RIDEM/DLR, 31 July, 1978). In 1985 the landfill accepted refuse for the last time. In 1988 a 20 ml cap was installed after PCB - contaminated auto-fluff was disposed at the site.

The three methods used for the landfilling of chemical wastes were disposal using surface impoundments, disposal by mixing with refuse, and drum disposal (RIDOH, 1970-1977). These methods of disposal are discussed in the following sections.

##### **3.1.1 SURFACE IMPOUNDMENTS**

A number of RIDOH inspection reports from 1970 till 1975 report the disposal of liquid and solid chemical wastes in trenches at the site. The "active" areas of chemical dumping were referred to as lagoons, trenches, pits and/or holes (RIDOH, 1970-1977).

1973 Lagoon(s) where oil was dumped were mentioned in the inspection reports. In addition, a report dated 25 July noted the use of a chemical pool approximately 100 feet long by 30-50 feet wide and about 4 to 5 feet deep. The pool was used for the disposal of material from Geigy Chemical and other plants. Approximately 2500

gallons/month of liquid waste were transported by trucks to the landfill for disposal at this pool. After chemical wastes were deposited, the liquid waste pools were filled in with a layer of fill, topped with a layer of refuse and then covered with another layer of fill. The use of the pool continued after a layer of landfill had been built up around and above the pool (RIDOH, 1970-1977).

The location of the chemical pool was moved when the landfilling area was moved. Before this year the location of the chemical pool changed according to what area of the landfill was in operation. During this period the northern portion of the landfill was the active area for waste disposal. Throughout the latter part of 1973 and the early part of 1974 dumping of chemical wastes in a pool located in the southern end of the landfill was noted (RIDOH, 1970-1977).

1974 In the second half of this year, the filling of this chemical pool began to be discussed. Correspondence between RIDOH/DSWM and City of Cranston personnel indicated that the practice of the pooling of chemical wastes at the landfill was to be discontinued to prevent the development of odors. From July 1974 to July of 1975 the progressive filling of the chemical pool was noted in almost every inspection (RIDOH, 1970-1977; RIDOH/DSWM, 1974d; RIDOH/DSWM, 1975a).

1975 By January of this year a report stated that the pit was approximately 50% filled. The pit was reported as completely filled by June. However, pooling of chemical wastes continued to be cited in reports from 1975 through 1978 (RIDOH, 1970-1977).

### **3.1.2 MIXING OF CHEMICAL WASTES AND REFUSE**

After the use of chemical pits was discontinued. Chemical wastes were mixed with refuse and covered at the end of the day. Even though the operators of the landfill and RIDOH/DSWM agreed upon this practice, numerous reports indicated that liquid chemicals continued to be pooled and that there were strong odors (RIDOH/DSWM, 1976b). In 1977 an inspection revealed the use of a liquid holding area that had been created by removing in place refuse to form a berm (RIDOH/DSWM, 1977).

### **3.1.3 DRUM DISPOSAL**

Disposal of drums containing chemical wastes at the landfill is documented as far back as 1970. Drum disposal was reported in 1970, 1976, 1977 and 1978. In 1970 and 1976 RIDOH inspections reported the disposal of drums containing chemical wastes and oil drums from Ciba-Geigy.

1970 A report dated 9 March noted that drums were abandoned in piles on the surface of the landfill, intended to rust, be crushed, and covered with fill. The regulator's recommendation at the time was that areas away from the landfill face be trenched and all barrels be set upright in these trenches and buried (RIDOH, 1970a).

A letter from RIDOH/Division of Solid Waste Management (DSWM) to the City of Cranston/Department of Public Works (DPW) indicated that barrels were present in the brook at the north end of the landfill (RIDOH/DSWM, 1970b).

- 1976 A report this year indicated that chemicals were being dumped from drums into an area dug from refuse. The fate of the drums was not noted.

A 2 February 1988 Providence Journal Bulletin article reported that according to court papers approximately 10,000 drums were disposed of at the site (PJB, 1988).

### 3.2 MONITORING

- 1975 The installation of monitoring wells at the site was first documented in a letter from RIDOH/DSWM to A. Capuano Bros., Inc. dated 9 December. The Rules and Regulations for Solid Waste Management Facilities had become effective the previous March and required the installation of monitoring wells at solid waste management facilities in the state (RIDOH/DSWM, 1975b and 1975d).
- 1976 Operating Plans of the landfill completed this year included the installation of monitoring wells at the site (Flock, 1976). An application for an operating license for the landfill was rejected because of violations (RIDOH/DSWM, 1976).
- 1977 In June of this year RIDOH issued a Consent Order regarding CSL license issuance, conditional on the installation of monitoring wells at the landfill (RIDOH/DSWM, 1977a). A 16 June letter to DSWM discusses the location of recently installed wells (A through F) (PAA, 1977; NETL, 1977). A 5 October letter from DSWM to Sanitary Landfill, Inc. indicated that operating regulations requiring the installation of monitoring wells also required that samples be taken from each well and analyzed by a certified laboratory at least once every three months. The letter continued and indicated that the "key indicator tests" to be conducted were specific conductance, pH, temperature, chloride, iron, color, turbidity and COD. "By conducting these tests, a determination was to be made as to whether or not the site was contaminating the ground waters. These 'key indicator tests' would also help in indicating which individual chemicals and/or chemical compounds should be tested for in the future" (RIDOH/DSWM, 1977 ).
- 1979 Analysis of groundwater samples was expanded to include chrome, copper, iron, nickel and zinc (NETL, 1979).
- 1981 Sampling records from this year to the present indicate quarterly sampling and analysis for VOCs and metals of the collected samples. The results of the analysis show detection of arsenic; barium; cadmium; lead; selenium; silver; benzene; chlorobenzene; 1,4-dioxane; ethyl benzene and toluene (NETL, 1981-1994).

1976 The Operating Plans for the Landfill indicated that no provisions for a leachate treatment system were planned (Flock, 1976). Numerous leachate outbreaks continued to be reported after installation of the dike.

1979 Lee Pare & Associates submitted a proposal for an investigation and preliminary design for a leachate collection system at the site (LPAI, 1970).

1980 The RIDEM Decision on the Appeal of the CSL license denial ordered the Department to issue the license to operate the CSL, conditional on:

1. proper grading and cover to reduce infiltration of precipitation into the refuse;
2. the conduct of investigations and submission of plans for the installation of a leachate collection system at the site; and
3. construction and operation of a leachate collection system.

(RIDEM, 1980a)

The RIDEM Decision reported that: "the leachate impact in the vicinity of the landfill was found to be severe". The leachate collection system, consisting of three tanks and drain pipe, was designed to intercept and store surficial contaminated groundwater and leachate seeps (RIDEM, 1980a).

Lee Pare & Associates completed for CSL an Engineering Study and Design and Operational Procedures for a Leachate Collection System (LPAI, 1979 and 1980). The installation of the system was finished on 17 September, (RIDEM/DAHM, 1980a). Nevertheless, inspections of the landfill still resulted in reported observations of leachate outbreaks. On a number of occasions the leachate collection tanks were allowed to completely fill. RIDEM requested the CSL to frequently inspect the tanks. "Whenever the tanks are found to be full, the collected leachate must be removed, manifested, and sent to a hazardous waste treatment facility" (RIDEM/DAHM, 1982c, 1983b).

1981 Early this year LPAI correspondence reported that plans were made and approved for the disposal of leachate into the Cranston sewer system (LPAI, 1981a, 1981b and 1981c)

1982 A letter dated 5 March, from RIDEM/DAHM to Lee Pare & Associates indicated that leachate from the collection tanks had been pumped and disposed of at the Cranston Sewer Treatment Plant (RIDEM/DAHM, 1982d).

Letters from RIDEM/DAHM to LPAI indicated that in order to determine the proper disposal of the leachate, samples would have to be collected and analyzed (RIDEM/DAHM, 1982a and 1982d). In December a sample was collected from the leachate collection tanks and analyzed for metals and VOCs (NETL, 1982).

- 1983 RIDEM/DAHM required that proper disposal of the leachate be arranged after the leachate was determined to be hazardous material due to the heavy metals content (RIDEM/DAHM, 1983f; LPAI, 1983b). A letter from LPAI to RIDEM reported that arrangements had been made for the disposal of the leachate at an incinerating facility in Newark, NJ (LPAI, 1983b).

Letters dated 14 July and 2 December, from RIDEM/DAHM to Jack Capuano reported that inspections of the landfill revealed that the leachate collection tanks were full and that leachate had been seeping out of the slopes near the leachate collection system (RIDEM, 1983f; RIDEM/DAHM, 1983b and 1983c).

- 1984 RIDEM/DAHM reported that inspections revealed that the leachate collection tanks were being allowed to fill and that evidence of overflow from the tanks was apparent (RIDEM/DAHM, 1984h and 1984i).

- 1993 On 18 August of this year, RIDEM/DSR personnel visited the site. During this visit the leachate collection system was inspected and was discovered that tanks were not accessible (Chatterton, 1993b).

The results section of this report contains the results of 1982 and 1985 samplings of the leachate collection tanks (NETL, 1982; NETL, 1981-1994; LPAI, 1982a).

### 3.3.3 CAPPING AND CLOSURE OF THE LANDFILL

- 1980 A 15 August Consent Order required a maximum final elevation of 107 feet above sea level (RIDEM, 1980d). On 31 October CSL filed a motion to modify the consent order, requesting that the final maximum elevation be changed from 107 to 125 feet (RIDEM, 1980e).

- 1981 LPAI letters to RIDEM reported the progressive landfilling of the southern half of the landfill (LPAI, 1981d, 1981e and 1981f). A 13 July decision on a motion to modify the consent order indicated that closure of the landfill was to occur when a final elevation of 107 feet was reached (RIDEM, 1981b).

A letter dated 5 August from LPAI to RIDEM indicated that the final lift was being placed on the southern section, bringing that section of the landfill to a top elevation of 107 feet. The letter reported that after this lift was completed filling operations would begin in the northern half of the landfill and would continue until the top elevation of that section reached 107 ft (LPAI, 1981g).

An order by RIDEM/DAHM, dated 17 November, required CSL to cease any further waste disposal at the south end of the landfill and submit plans for the closure of this area (RIDEM/DAHM, 1981b).

- 1982 A letter from Lee Pare Engineering, dated September, indicated that the southern half of the landfill (the active half of the landfill) was to be closed using a 10 ml PVC cap (RIDEM/DAHM, 1982a; LPAI, 1982b). The cap was to be covered with at least two feet of soil and vegetated with a grass crop (RIDEM/DAHM, 1984j).
- 1983 A 31 May letter from LPAI to RIDEM reported that the final maximum elevations in the southern half of the landfill were between 107 and 109 feet. The letter stated that no refuse filling took place above the 105 foot elevation; that only clean fill or fly ash was placed there. The letter also indicated that refuse filling was no longer allowed in this section (LPAI, 1983a). Landfilling operations were limited to the northern section of the landfill.
- 1984 A 4 April letter from RIDEM/DAHM to CSL reported the deadlines for the closure of the south end of the landfill and required the submission of plans for the complete closure of the landfill (RIDEM/DAHM, 1984d). On 10 April LPAI submitted to RIDEM the results of a 3 April, topographic survey (LPAI, 1984a). On 13 April, RIDEM/DAHM informed CSL that the final elevations at the south end of the landfill exceeded the 107 elevation required maximum. Therefore CSL was found to be in violation of the 15 August, 1980 consent order (RIDEM/DAHM, 1984c).
- A consent order, dated 5 July, stated that no refuse or waste was to be accepted or deposited at the landfill after 1 November of this year (RIDEM/DAHM, 1984f). The consent order was amended to allow landfilling to continue until 31 January, 1985 after LPAI requested an extension on the closure for Sanitary Landfill, Inc. (RIDEM/DAHM, 1984g; LPAI, 1984e).
- On 21 May, LPAI submitted to RIDEM/DAHM the closure plans for the landfill on behalf of CSL (LPAI, 1984d).
- 1985 Landfilling was extended until 6 February, (RIDEM/DAHM, 1985a).
- A 17 October letter from RIDEM to CSL indicated that the placement of the cap had been completed. At this time the placement of clean cover and loam to develop a vegetative cover remained was not completed (RIDEM/DAHM, 1985a).
- 1988 On 22 March, RIDEM/DAHM issued a Notice Of Violation (NOV) to CSL after sampling at two locations within the landfill showed levels of PCBs in soil in excess of fifty (50) parts per million (ppm). The NOV stated that CSL accepted hazardous waste without an appropriate manifest, operated a hazardous waste disposal facility without a permit, and operated a land disposal facility without a permit. CSL was ordered to immediately discontinue the acceptance of hazardous wastes at the landfill, immediately cover all exposed foam material with a synthetic membrane, and clean up foam material that had migrated from the landfill to surrounding areas (RIDEM/DAHM; 1988a). A synthetic 20 ml cap was installed on the entire area of the landfill during this year.

### 3.3.4 AIR MIGRATION AND GAS RECOVERY SYSTEM

A number of complaints from residents in the vicinity of the landfill reported the detection of odors near the site throughout its history (RIDEM/DLR/SWMP, 1978a and 1978c; RIDEM/DAHM, 1984a; PRA, 1986).

- 1980 On 29 September, in response to the odor complaints, RIDEM/DAHM conducted air testing at the site using a portable gas chromatograph testing was done immediately outside the landfill on Pontiac Avenue and at the leachate collection system. During sampling an odor was evident on Pontiac Avenue, and the results showed that organic vapor levels were over 200 ppm. The GC indicated that the 200 ppm reading was almost entirely due to methane (RIDEM/DAHM, 1980b).
- 1981 A letter, dated 7 May, from RIDEM/DAHM to the Department of Housing and Urban Development (Boston, MA), stated that investigations by RIDEM/DAHM in the area of the landfill had shown that although slight odors might exist at times during the operation of the landfill facility, laboratory analysis of the air quality indicated that no hazardous constituents were present in the area (RIDEM/DAHM, 1981a).
- 1983 A letter from the Rhode Island Department of Mental Health, Retardation and Hospitals (DMHRH), to RIDEM indicated that the use of methane from the landfill was being considered as a supplemental energy source for the DMHRH Power Plant (DMHRH, 1983; RIDEM, 1983b).
- 1984 Along with the closure of the landfill the placement of a cap and a gas recovery system were being considered. This year an active methane system extraction was first installed. A 22 May, letter from American Gas Recovery Corporation informed RIDEM/DAHM that probe tests would be conducted to assess the feasibility of a landfill gas recovery project at CSL (AGRC, 1984a, 1984b and 1984c).
- A 30 May letter from RIDEM requested that Lee Pare & Associates include in the Closure Plans for the landfill a schedule for the installation of a passive venting system. RIDEM required that the passive venting system be installed within 90 days of the removal of the active methane extraction system (RIDEM/DAHM, 1984e).
- An 11 October, letter from RIDEM/DAHM to CSL indicated that the methane gas recovery project at the landfill had been postponed and was not scheduled to be in place in the near future. RIDEM required that a passive gas venting system along the perimeter of the liner - covered area be installed as an attempt to prevent the possibility of gas being trapped beneath the liner and migrating through the ground into the basements of nearby buildings (RIDEM/DAHM, 1984e).
- 1985 A 12 June site inspection by state personnel revealed that four methane gas test wells were installed by American Gas Recovery to determine the feasibility of installing methane recovery wells at the site.

1988 A letter dated 19 May from RIDEM to CSL's attorney required the installation of gas vents along with the placement of the second cap.

By September gas vents had been installed at the site.

1989 In October of this year six gas extraction wells, gas piping and a flaring unit were installed at the site.

1990 An amended consent agreement between RIDEM/DAHM and Sanitary Landfill, Inc., Jack Capuano and Daniel Capuano, owners, indicated that CSL would submit plans to RIDEM indicating the final methods and technologies that were to be used to control air migration and a narrative of the methane testing program that was to be employed to assure that off-site migration of landfill gas would not occur.

1993 CSL applied to RIDEM/Division of Air Resources (DAR) to connect two gas extraction laterals along Pontiac Avenue to the existing flare system. In August RIDEM/DAR personnel inspected the flare system and found it to be inconsistent with the flare design that had been submitted with the 1989 application. In September, RIDEM/DAR approved the connection of the two gas extraction laterals to the existing flare system conditional on CSL modifying the flare to meet the design of the original permit application.

#### **4. REGULATORY HISTORY**

In January of 1978 CSL began submitting manifests to RIDEM after the Emergency Rules and Regulations for Industrial Waste Disposal Sites and Waste Disposal Sites became effective on 23 December, 1977. In addition, RIDEM required that CSL submit information regarding the location of the site, the types of waste disposed of, the source of these wastes, and the methods used in their disposal. In a letter dated 13 January 1978, CSL informed RIDEM that the method of disposal was "burial" in accordance with current state regulations. In the 13 January 1978 letter CSL reported that it was accepting the following wastes: miscellaneous chemical sludge and/or residues; acidic by-products; alkaline residues; chemical lab samples; industrial pre-treatment & treatment sludge; hospital waste; electroplating wastes; rubber; waste oil; empty chemical packaging; paint and lacquer residue; and industrial waste. CSL reported in the same letter the acceptance of wastes from Homart Development Company; Great Lakes Container Corporation; Washburn Wire Company; Kaiser Aluminum & Chemical; Industrial Machine Corporation; Ciba-Geigy Corporation; United Wire & Supply Corporation; Cranston Print Works; Scott Brass, Inc.; Davol Rubber Company; Getty Oil Company; Mobil Oil Corporation; Wayland Chemical Company and American Hoechst Corporation.

The following companies also disposed of waste at CSL, according to manifests filed with the state; Brown & Sharpe Manufacturing Company; Booth Brothers; Amico, B.P. Station; Bald Hill Auto Body; BIF Industries; Cleveland Grinding and Twist Drill Co.; City of Cranston; Chemart Company; C.I. Hayes City Tire Company; Bird and Son; Cranston Treatment Plant; Cranston Casting Company; Collier Insulated Wire Company; D+L Services; Dry Vit Systems; Freeway Car Wash; Firestone Foam Products Co.; GE Wilson Company; Hoffacker Co.; Philip A. Hunt Chemical Corporation; Lincoln Insulation System; Providence Journal; Providence County Court House; Pram Washing Service; Midland Mall Restaurant; Narragansett Electric; Pocasset Food; Mack Trucks; Reliance Plastics; National Bottle; Roger Williams Park; Okonite Company; New England Container; Sky View Motor, Inc.; Sealol; Speidel Division of Textron; Shell Oil; Sunbeam Bread; Taco; U.S. Coast Guard; U.S. Naval Base; Warwick Sewer Authority; Whitman Product Corporation; Wiley Taylor and Zapata Marine.

In 1978 RIDEM issued a number of Notice of Violations (NOVs) to CSL for problems with the daily cover and dumping within 200 feet of surface water (RIDEM/DLR/SWMP, 1978).

State Hazardous Waste Disposal Facility Rules and Regulations became effective in part on 21 December, 1978 and in part on 21 June, 1979 (RIDEM/DLR/SWMP, 1979a). In 1978 letters from RIDEM/DSWM to CSL revealed deficiencies on the accuracy of the information supplied in the manifests. In 1979 RIDEM/DLR/SWMP issued three NOVs to CSL, because the facility was accepting waste without complete manifests and/or no manifests.

On 1 November 1979, the site was entered on EPA's list of potential hazardous waste sites (CERCLIS), as Cranston Sanitary Landfill, EPA ID RID084812577.

A 30 May 1980, RIDEM hearing officer's decision allowed CSL to continue operations and ultimately be issued a license, conditional upon regrading and covering of the landfill to reduce infiltration and construction and operation of a leachate collection and treatment system (RIDEM, 1980a).

On 7 July 1980, RIDEM ordered CSL to cease landfilling operations after the requirements of the 30 May 1980 order were not met (RIDEM, 1980c). A 15 August 1980 consent order allowed CSL to continue landfilling on the southern half of the property to a final elevation of 107 feet. The consent order required the construction and operation of a leachate collection system for intercepting and collecting the surface and near-surface leachate from the landfill. On 31 October 1980 in a motion to modify the consent order, CSL requested that final elevations be changed from 107 to 125 feet. A 13 July 1981 decision on a motion to modify the consent order indicated that closure of the landfill was to occur when a final elevation of 107 feet was reached (RIDEM, 1981b).

On 17 November 1981 RIDEM ordered CSL to cease any further disposal of solid waste in the southern end of the facility and to submit a plan for the closure of this area.

On 15 March and 1 May 1982 a Preliminary Assessment (PA) and a Site Inspection (SI) of the site were completed.

In December 1982 Lee Pare & Associates, as a contractor for CSL, collected a sample from the leachate collection system. The sample was analyzed for filtered heavy metals and SVOCs. In addition, other parameters tested for included pH, specific conductance, TOC, chloride and iron. The results section of this report contains a list of the parameters and constituents and the respective measurements and concentrations.

On 9 July 1984 RIDEM issued an amended consent order to CSL allowing the landfill to accept or dispose of refuse until November 1984. An 18 December 1984 Superior court order allowed the landfill to accept refuse until 31 January 1985. This date was later extended to 6 February 1985 when the landfill accepted refuse for the last time (RIDEM/DAHM, 1985a).

On 22 March, 1988, RIDEM/DAHM issued a Notice Of Violation (NOV) to CSL after sampling at two locations within the landfill showed levels of PCBs in excess of 50 parts per million (ppm). The NOV was issued because CSL accepted hazardous waste without an appropriate manifest, operated a hazardous waste disposal facility without a permit and operated a land disposal facility without a permit. CSL was ordered to immediately discontinue the acceptance of hazardous wastes at the landfill, immediately cover all exposed foam material with a synthetic membrane and to clean up foam material that had migrated from the landfill to surrounding areas (RIDEM/DAHM; 1988a). A synthetic 20 ml cap was installed on the entire area of the landfill in 1988.

In October of 1990, U.S. EPA completed a Site Analysis of Cranston Sanitary Landfill. The report contains an analysis of aerial photography of the site.

In December 1993, RIDEM/DSR personnel conducted a site inspection of CSL. Samples collected during this inspection from monitoring wells at the site were split by New England Testing Lab (NETL, the contractor for CSL), and CDM (the contractor for RIDEM/DSWM). At that time six of the seven monitoring wells at the site, including well Z, the background well, were sampled for metals and VOC analyses. Figure 2 is a sketch of the site showing the location of the present monitoring wells. The results of this 1993 sampling show detection of arsenic; barium; benzene; chlorobenzene; 1,4-dioxane; ethyl benzene; toluene; 1,2,4-trimethylbenzene; 1,3,5-trimethylbenzene and total xylene at concentrations greater than three times the background concentrations. The results of the sampling are discussed and presented in the results section of this report (NETL, 1981-1994). During the December 1993 visit the leachate collection system was inspected. Prior to removing the concrete top that gives access to the manhole a strong chemical smell was noticed. The first concrete cover was removed and a manhole leading to a second (lower) concrete cover was encountered. The diameter of this second cover appeared to be larger than the diameter of the manhole, and an inspection of the tanks was not possible (Chatterton, 1993b).

In December of 1993, RIDEM/DSR personnel also conducted an onsite reconnaissance as part of the ESI. A total of 14 sediment samples, including 3 background samples and one duplicate, were collected from the unnamed stream adjacent to the landfill. In addition, 4

samples including two background samples were collected from the Pawtuxet River. The samples were analyzed for metals, VOCs, SVOCs and PCBs. Figure 2 is a sketch of the site showing the approximate location of the sediment samples. The results of the analyses show detection of arsenic, cadmium, chromium, acetone, benzo(a)anthracene, chrysene, chlorobenzene, dichlorobenzene, methylene chloride, methyl ethyl ketone, pyrene, toluene and xylene at concentrations significantly greater than background concentrations (ESS, 1993; Chatterton, 1993c). The results of the sampling are discussed and presented in the results section of this report.

## 5. WASTE CHARACTERISTICS

A 1981 RIDEM decision on a motion to modify the consent order stated that an estimated 325 tons of refuse per day were accepted for landfilling at the site.

Table 1 presents an evaluation of the sources at the site.

Table 2 presents a summary of the quantities of hazardous wastes documented through manifests to have been disposed of at the site between January 1978 and October 1979. In addition to the waste listed in Table 2, approximately 900,000 lbs and 645,000 gallons of waste were manifested and disposed of at the site. This included papers and chemical byproducts, chemical filter residues, mixed organic chemicals in jars, water with coolant, insoluble zinc oxides and organic byproducts, chloride salts, acetone buta, sand, zinc, speedy dry, organic distillate, machine coolant, rubber, aqueous acid residue, solvents and polynuclear aromatic among others.

In addition, there is evidence of hazardous waste disposal at the site before and after the period during which manifests for hazardous wastes disposal were filed. Between 1970 and 1975, an electrical component manufacturer in Connecticut disposed of approximately 137,000 lbs of liquid waste containing PCBs at the site (EEI, 1982).

In 1988, RIDEM/DAHM issued a Notice Of Violation (NOV), to CSL after sampling at two locations within the landfill showed levels of PCBs in excess of 50 ppm. In March 1988 nineteen samples were collected from the site, eleven of the samples showing concentrations greater than or equal to 1 ppm. The concentrations of PCBs in the eleven samples ranged from 1 ppm to 178 ppm. Samples were also collected from lots in the vicinity of the landfill. PCBs were detected at 5 ppm, 21 ppm and 24 ppm in three of the lots with residences, and a concentration of 149 ppm was detected in loose fluff collected from a baseball field.

**Table 1**  
**Source Evaluation for**  
**Cranston Sanitary Landfill**

Potential Source Area	Containment Factors	Spatial Location
Oil Lagoon	No liner or cap. There is evidence of migration of contaminants to ground and surface waters.	Northern half of the landfill.
Leachate Collection Tanks	The leachate collection system is not maintained. Migration of leachate to the adjacent stream was observed. There is evidence of migration of contaminants to ground and surface waters.	Western and northwestern edge of the landfill
Chemical Pools (or trenches)	No liner or cap. There is evidence of migration of contaminants to ground and surface waters.	Northern and southern halves of the landfill (the location for the pooling of chemicals was moved along with landfilling)
Landfilled Area	Cap, Leachate Collection System, Dike. There is evidence of migration of contaminants to the ground and surface waters.	Most of the property was landfilled

(RIDEM/DAHM, 1986b; RIDEM/DWR, 1986a)

Table 2

**Hazardous Waste Quantity Estimated From  
1978-1979 Manifests  
Cranston Sanitary Landfill**

Substance	Quantity	Date of Disposal	Source Area
Metal Sludge containing: Aluminum (0.53 ppm), Nickel (3 ppm), Zinc (430 ppm), Cadmium (4.5 ppm), Copper (40 ppm), Silver	4,000 gal	7/5/79	Possibly Dump and/or Landfill (unknown exact location within the property)
Methanol*	7,040 kg	3/11/78	Landfill
Naphtha (80%) TCE (20%)	1,870 gal	1978, 1979	Landfill
Sodium (4,550 ppm)	76,000 gal	1979	Landfill
Pyrene (5%)	1,580 lbs	3/19/79	Landfill
Ferrous Sulfate (19%)	35,300 gal	1979	Landfill
Formaldehyde (10%)	120 gal	3/15/78	Landfill
Sulfuric Acid (10%), Copper (22,900 ppm), Zinc (9,700 ppm)	16,000 gal	1978	Landfill
Copper (2.3%)	28,000 gal	1979	Landfill
Zinc (0.96%)*	22,000 gal	1979	Landfill
Hydrochloric Acid (15%)	3,500 gal	1/28/78	Landfill
Sulfuric Acid (10%)	8,060 gal		Landfill
Muriatic (10%)	60 gal	5/4/78	Landfill
Bromide (1%)	7,560 gal	5/24/78	Landfill
Chloride (5%) Sulfate (1%)	21,140 gal	1978	Landfill
Ammonia (6.1%)*	5,995 gal	1979	Landfill
Sulfanilamide	70 lbs	6/18/79	Landfill
Oxyfen	35 lbs	6/18/79	Landfill
Furane	571,610 lbs	1978-1979	Landfill

(RIDOH, 1978-1979)

**Table 2 (continued)**

**Hazardous Waste Quantity Estimated From  
1978-1979 Manifests  
Cranston Sanitary Landfill**

Substance	Quantity	Date of Disposal	Source Area
Aqueous alkaline residue: Sodium Hydroxide (22%), Sodium thiosulfide (15%), Sodium Sulfide (2%), Sulfur (1%)	72,000 gal	1978	Landfill (unknown exact location within the property)
Nitric Acid with water	2,500 gal	4/7/78	Landfill
Monochlorobenzene/ Organic Tars/ Sulfuric Acid	175 kg	3/1/78	Landfill
Toluene (Waste)	---	1978	Landfill
Acetone (Trace)	150 kg	3/26/79	Landfill
Furfuryl Amine (85%), Sodium Chloride (15%)	32,200 gal	08/1978	Landfill
Isobutyl Acetate	(75%) 75 drums (25-75%) 66 drums	—	Landfill
Zinc Hydroxide (4%), Fluoroborate (32%)	41,168 lbs	4/24/78	Landfill
Zinc Hydroxide (15%), Calcium Hydroxide (5%), Calcium Chloride (45%)	88,822 lbs	1978	Landfill
Copper Chloride (4.5%), Zinc Chloride (2.1%), Iron Chloride (30%)	35,300 gal	1979	Landfill
Tin Fluoride Tin Chloride	100 gal	10/25/79	Landfill
Tin/ Sulfuric Acid	600 kg	3/20/78	Landfill
Hydroxy Diphenyl, Amine, Amino Diphenyl, Sodium Chloride	1000 gal	2/27/79	Landfill
Ethylene, Glycol, Potassium Carbonate	2375 gal	1978	Landfill

(RIDOH, 1978-1979)

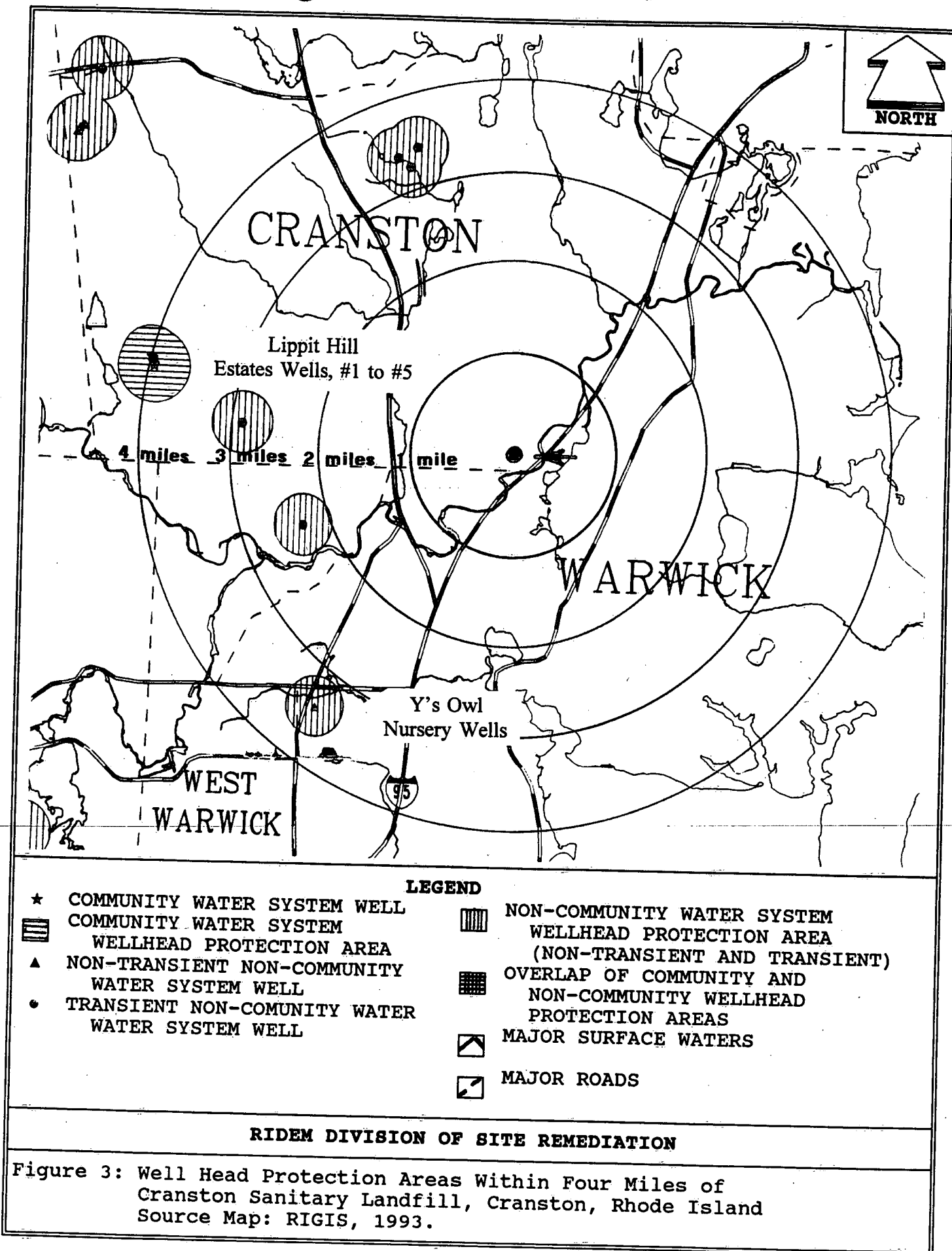
## 6. ENVIRONMENTAL SETTING

CSL is located in the densely populated City of Cranston. Major portions of the cities of Cranston and Warwick and some areas of Providence and West Warwick are located within four miles of the site. Land uses in the vicinity of the landfill were determined from aerial photographs. The photographs indicate that the predominant land uses within 0.25 miles of the site are high density commercial and residential and wetlands (Aerographics, 1988).

The average temperature in the area of the landfill is approximately 50.3°F, with the coldest and warmest months being January and July with mean temperatures of 28.8°F and 72.5°F, respectively. The average annual precipitation for the area is 45.3 inches. The months with the highest and lowest average precipitation are December (4.47 inches) and June (2.79 inches). The aforementioned temperature and precipitation values are averages of 44 years of records for the Providence WSO Airport (Green Airport) station (NOAA, 1993). This station, located in Warwick, RI, is approximately 1.5 miles east of the site (USGS, 1957a).

The site is characterized by generally high topographic relief. Elevation varies approximately 90 ft between the toe and the highest point in the landfill. The property is occupied by a building surrounded by a paved area, the landfill of approximately 40 acres in extent, and a dirt road that runs along the southeastern boundary of the landfill. The landfilled area has a grass vegetative cover. This cover and drainage channels installed in 1990 were designed to minimize erosion of the clean fill that covers the second cap. However, partial erosion of the clean fill can be observed on the faces of the landfill (Chatterton, 1994; Pare, 1990).

The USGS surficial geology map of the East Greenwich Quadrangle indicates that a variety of surficial deposits, including kame terraces, ground moraine, alluvium deposits and river terrace deposits occupied the site and its vicinity. The contact between the kame terraces and the ground moraine deposits trends approximately north-east south-west through the middle of the site. The kame terraces at the site overlie till and the bedrock highlands of Slate Hill. Kame terraces are described as mainly sand and gravel left along the valley walls when the valley glacial ice melted. Kame terraces along the Pawtuxet River slope steeply toward the stream. The maximum thickness of the kame terrace on the Pawtuxet River is 15 ft. The river bounded areas of the landfill are occupied by ground moraine. These deposits are described as an irregular layer of till of variable thickness deposited over bedrock. Till is composed of a poorly sorted, non-stratified mixture of gravel, sand, silt and clay. Review of drillers' logs indicates that within the bedrock highlands the till varies in thickness from 10 to 30 feet. The till is formed when glacially-scoured soil and bedrock materials are deposited by lodgement between the bedrock and the moving ice mass. As a result, the contours of the till reflect the topography of the underlying bedrock. The lowest area of the landfill and adjacent floodplain are occupied by river-associated sediments composed of river terrace deposits and alluvium. River terrace deposits consist chiefly of coarse alluvial sand and silt along the Pawtuxet River. Alluvium deposits consist of sand, gravel and silt (Smith, 1955). Previous investigations at the site indicate that the alluvium varies in thickness from 5 to 25 feet.



Geographic Information System (RIGIS) 1990 Census Tract Map was used to estimate the population within different distance categories within four miles of the site. The population estimates were then multiplied by the percentages of private water well users for each city to calculate estimates of private well users within four miles of the site. The four mile radius from the site also includes a substantial area in the City of Cranston which is not at all supplied by public water. For this area the estimated population was used as an estimate of the population served by private wells. Table 3 shows the populations served by public wells within four miles of the site and their locations relative to the site (RIDOH, 1990). Estimates of the population supplied by groundwater resources located within four miles of the site are presented in Table 4. Given the hazardous waste disposal practices at the landfill, the exact spatial location of hazardous substances within the property is difficult to determine. The location of the nearest private well was not determined but was reported in a NUS/FIT 1990 target memo of the site to be approximately 1.5 miles from the site (NUS/FIT, 1990).

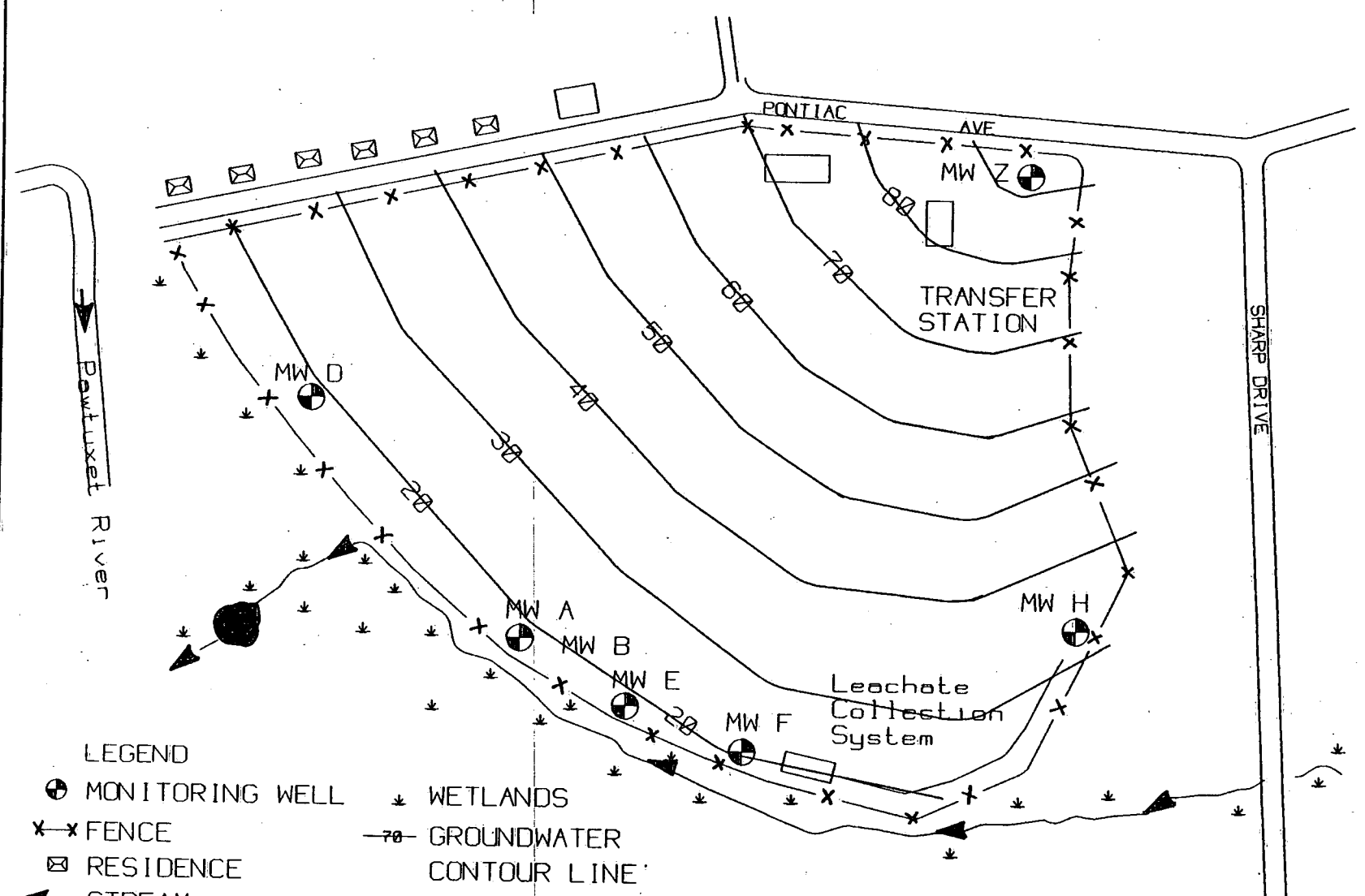
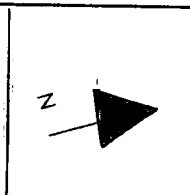
**Table 3**  
**Public Groundwater Supply Sources Within Four Miles of**  
**Cranston Sanitary Landfill**

Distance/ Direction from Property	Source Name	Location of Source/Type of well	Estimated Population Served	Source Type
3.5 mi/SW	Y's Owl Nursery	Warwick/ Non-transient, non- community well	84	Unknown
3.98 mi/ 5° N of W	Lippit Hill Estates Wells #1 to #5	Cranston/ Community well	300	Unknown

(RIGIS, 1992a; RIDOH, 1990)

Note: a public well is a well that supplies water to a system that provides drinking water to 15 or more service connections or regularly serves an average of at least 25 individuals daily at least 60 days of the year.

A groundwater contour map of the site was developed by Pare Engineering for CSL. The map, dated 16 March 1990, indicates that groundwater in the area flows in an easterly and/or southeasterly direction toward the unnamed stream and associated wetlands located adjacent to the site. This adjacent, unnamed stream was sampled by RIDEM/DSR in December, 1993 as part of the ESI. Figure 3 is a modified copy of the groundwater contour map.



LEGEND

- ⊕ MONITORING WELL
- ✕✕ FENCE
- ⊠ RESIDENCE
- STREAM
- POND
- BUILDING
- ✕ WETLANDS
- 70- GROUNDWATER CONTOUR LINE

NOT TO SCALE

NOTE: MODIFIED FROM PARE ENGINEERING CORPORATION  
"GROUNDWATER CONTOURS", 1990

RIDEM/ DIV. OF SITE REMEDIATION  
FIGURE 4: GROUNDWATER CONTOUR MAP  
CRANSTON SANITARY  
LANDFILL

CSL.DWG

Cross-sectional plots of the site indicate the presence of refuse below the water table. In addition, inspection reports and aerial photographs of the landfill indicate that surface water bodies were present within the boundaries of the landfill. The disposal locations of hazardous materials relative to the water table has not been determined, but sampling of monitoring wells at the site has revealed migration of contaminants to the groundwater. Groundwater monitoring wells were first installed at the site in 1977. From 1977 to the present they have been sampled quarterly. A summary of sample collection from 1986 to the present is shown in Appendices 1 and 2. There are presently seven monitoring wells, including one background well, at the site. Analysis of samples collected from these wells in 1993 showed arsenic; barium; benzene; chlorobenzene; 1,4-dioxane; ethyl benzene; toluene; 1,2,4-trimethylbenzene; 1,3,5-trimethylbenzene and total xylene at concentrations greater than three times the background concentrations. The results of the aforementioned 1993 sampling are discussed and presented in the results section of this report.

**Table 4**

**Estimated Drinking Water Populations Served by Groundwater Sources  
Within Four Miles of  
Cranston Sanitary Landfill**

Radial Distance From Cranston Sanitary Landfill (miles)	Estimated Population Served by Private Wells	Estimated Population Served by Community Wells	Total Estimated Population Served by Groundwater Sources Within the Ring
0.00 < 0.25	0	0	0
0.25 < 0.50	0	0	0
0.50 < 1.00	0	0	0
1.00 < 2.00	221	0	221
2.00 < 3.00	328	0	328
3.00 < 4.00	894	84	978
<b>TOTAL</b>	<b>1,443</b>	<b>84</b>	<b>1,527</b>

(Chatterton, 1993b; RIGIS, 1992a)

## 6.2 SURFACE WATER PATHWAY

The ground surface at the site is located approximately 110 ft above mean sea level (USGS, 1957a). The site is on a surface water divide with the area recharging the site's groundwater apparently being limited to the extent of the landfill (USGS, 1957a; LPAI, 1990). The site is located in a greater than five hundred year flood plain (USDHHD, 1972).

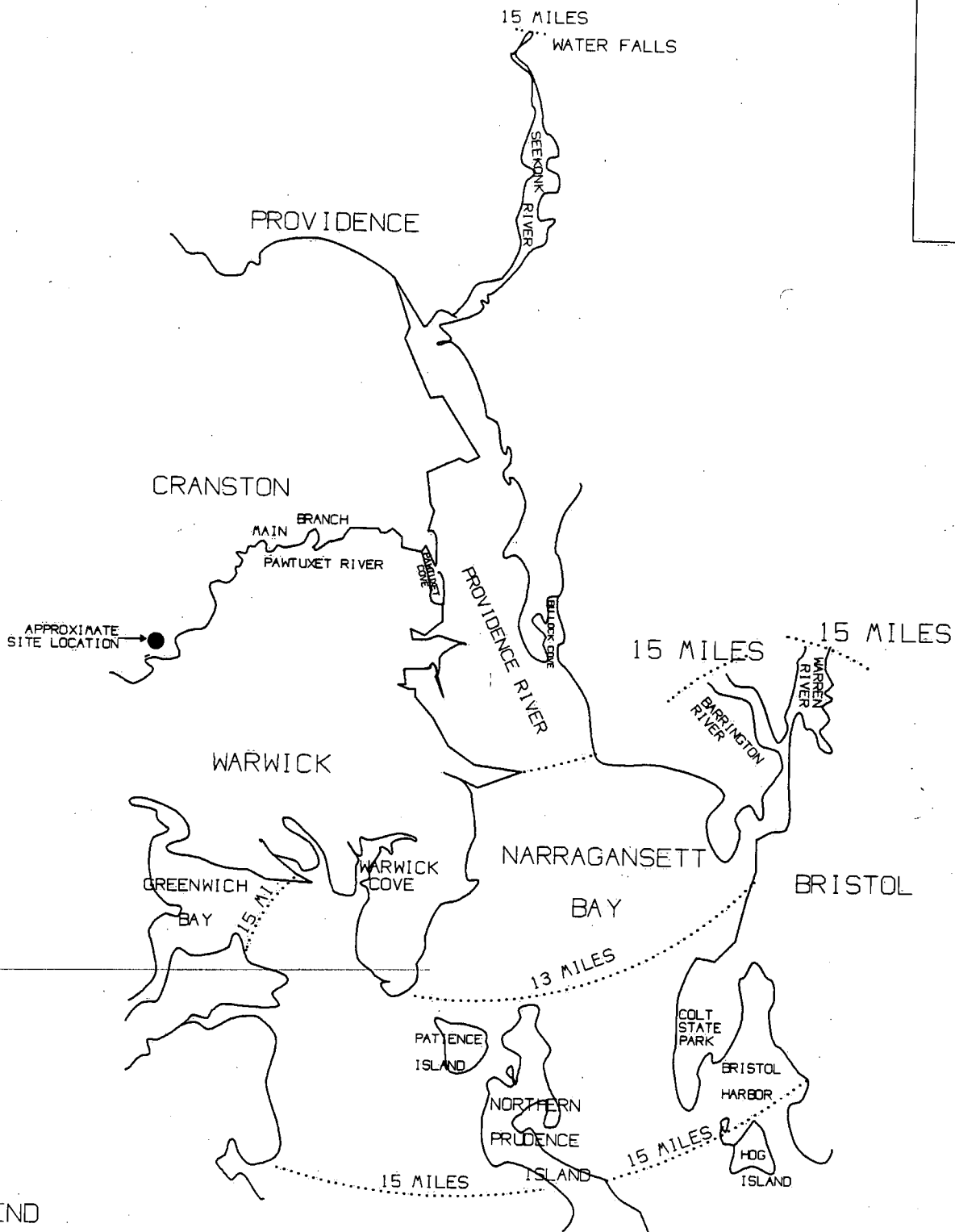
The site's potential surface runoff path is toward an unnamed stream and wetlands east and southeast of the landfill. In order to control runoff and minimize infiltration and erosion, a runoff control system was constructed in 1990. The drainage channels were designed to collect runoff from 38 of the 47 acres of the landfill. The collected runoff discharges at three points along the toe of the landfill. Two drainage channels discharge into the unnamed stream, and one drainage channel discharges into a wetland at the southernmost point of the landfill (LPAI, 1990). The reach of the unnamed stream adjacent to the landfill is approximately 1,500 feet long (Aerographics, 1990). Downgradient of this reach the stream turns southeast away from the landfill, and flows into a one quarter-acre pond. A stream approximately 50 feet long connects the pond to the Main Branch of the Pawtuxet River. The flow path in the Pawtuxet River is approximately 5.0 miles before entering Pawtuxet Cove. The flow path in the Pawtuxet Cove is approximately 0.5 miles before entering the Providence River.

The Providence River is a tidal surface water body, and the entire length of the river is within the surface water pathway of the site. The upstream portion of the surface water pathway from Pawtuxet Cove includes 4.2 miles of the Providence River before meeting the Seekonk River. The flow path in the Seekonk River is approximately 4.2 miles to Main Street Waterfalls. These falls prevent all upstream reaches from being tidally influenced. Other tidally influenced surface water bodies located upstream of Pawtuxet Cove and within the 15 mile surface water pathway of the site include Watchemocket Cove and the lower reaches of the Woonasquatucket River.

The downstream portion of the surface water pathway from Pawtuxet Cove includes 3.33 miles of the Providence River and 5 miles of Narragansett Bay. Once in Narragansett Bay the surface water pathway includes all tidal surface water bodies that fall within the 15 mile target distance limit of the site. These surface water bodies include but are not limited to: Greenwich Bay, Hope Bay, and the Barrington, Palmer and Warren Rivers (USGS, 1955a, 1955b, 1955c, 1957a, 1957b and 1971). Figure 5 shows Cranston Sanitary Landfill's surface water pathway.

Table 5 presents the surface water bodies within the surface water pathway of Cranston Sanitary Landfill. A water quality classification of these surface water bodies is presented in Table 6.

The flow estimated for the Pawtuxet River was obtained from the USGS "Water Resources Data for Massachusetts and Rhode Island" publication. A USGS gaging station is located on the Main Branch of the Pawtuxet River approximately 1.7 miles downstream from the point of discharge of the unnamed stream into the Pawtuxet. The average discharge at this station, estimated from 50 years of records (1940-1991), is approximately 346 cfs.



# LEGEND

 DISTANCE FROM MOST DOWNSTREAM PROBABLE POINT OF ENTRY

NOT TO SCALE

RIDEM/ DIV. OF SITE REMEDIATION  
 FIGURE 5: CRANSTON SANITARY LANDFILL  
 SURFACE WATER PATHWAY

Along the surface water pathway there is a series of wetlands of various types including emergent, scrub-shrub, deciduous-forested, and coniferous-forested wetlands (RIGIS, 1992b). The total frontage of wetlands along the pathway is approximately 7.5 miles. A wetlands frontage division by surface water body is presented in Table 5.

Along the surface water pathway of Cranston Sanitary Landfill there are a number of sensitive environments, including Hog Island and the Palmer River. Table 7 presents the ecologically sensitive environments along the surface water pathway and the number of species for which these environments serve as habitats (RIGIS, 1992c). Narragansett Bay (10 miles from the site), an estuary identified under the National Estuary Program, is a major fishery in the state of Rhode Island (USEPA, 1992). "Marine species which are commercially harvested in the Narragansett Bay area include hardshell clams (19 million pounds annually), and lobster (1.15 million pounds annually). In addition, conch (in smaller amounts) and finfish, including flounder, herring, bluefish and striped bass, are also harvested commercially" (NUS/FIT, 1992). Patience Island (a management area) along with Northern Prudence Island, are areas in Narragansett Bay designated as part of the National Estuarine Research Reserve. Some state parks located along the surface water pathway of the site include Goddard Park, Colt State Park and Bay Island Park (RIGIS, 1992d).

**Table 5**  
**Water Bodies Within the Surface Water Segment of**  
**Cranston Sanitary Landfill**

Surface Water Body	Descriptor	Length of Reach (miles)	Flow(cfs)	Length of Wetlands
Unnamed Stream, Wetlands	Wetlands	0.3	<10 cfs	0.6 miles
Pawtuxet River	Moder.-Large stream	6.2	100-1000 cfs	7.05 miles
Pawtuxet Cove	Moder.-Large stream	0.4	100-1000 cfs	0 miles
Providence River	Coastal Tidal Waters	3.33 down 4.2 up	NA	0 miles
Seekonk River	Coastal Tidal Waters	4.2 up	NA	0 miles
Narragansett Bay	Coastal Tidal Waters	5	NA	0 miles

NOTE: \* tidal water bodies within the target distance limit include but are not limited to: East Greenwich Bay, Mount Hope Bay, Barrington, Palmer and Warren Rivers.  
(USGS, 1975; Chatterton, 1993c)

**Table 6**

**Water Quality Classification of Surface Water Bodies  
Within the Surface Water Pathway of Cranston Sanitary Landfill**

WATER BODY	CLASS	DESCRIPTION
Unnamed Stream and associated wetlands*, Pawtuxet River	C	Suitable for fish and wildlife habitat, recreational boating, and industrial processes and cooling; good aesthetic value.
Pawtuxet Cove, Seekonk River, northern half of Providence River, northern half of the Warren River	SC	Suitable for fish, shellfish and wildlife habitat; suitable for recreational boating, and industrial cooling; good aesthetic value.
Southern half of Providence River, southern half of Warren River	SB	Suitable for bathing, other recreational purposes, industrial cooling and shellfish harvesting for human consumption after depuration; excellent fish and wildlife habitat; good aesthetic value.
Narragansett Bay, Greenwich Bay, Mount Hope Bay, Barrington River, Palmer River	SA	Suitable for all saltwater uses including shellfish harvesting for direct human consumption, bathing and other water contact sports.

(RIGIS, 1990)

Note: \* Classification for the adjacent unnamed stream are not presented in the RIGIS source map. However, due to the industrialized nature of the area and the presence of the landfill and contaminants found in the stream, this surface water body was assumed to be Class "C".

**Table 7**

**Ecologically Sensitive Environments  
Along 15 Mile Surface Water Pathway of Cranston Sanitary Landfill**

Name of Sensitive Environment	Downstream Distance from PPE (miles)	Number of Species in Habitat
Palmer River	14.5	6 C 3 SSI 2 ST
Hog Island	15	3 SSI 1 ST
Providence River Marsh		----

C= State Specie of Concern

SE= State Endangered Specie

SSI= Specie of State Interest

ST= State Threatened Specie

(RIGIS, 1992c; USGS, 1957a, 1957b, 1955a and 1971)

In 1993, RIDEM/DSR personnel visited the site for a survey of the surface water bodies in the vicinity of the landfill and to determine the best and most accessible locations for the collection of sediment samples. During this visit buried refuse beyond the landfill boundaries was observed. The refuse was seen along the eroded stream banks of the unnamed stream in the area where the stream meets the Pawtuxet River.

In 1993, RIDEM/DSR personnel collected sediment samples from surface water bodies in the vicinity of the site. A total of 14 sediment samples, including 3 background samples and one duplicate, were collected from the unnamed stream adjacent to the landfill. In addition, 4 samples, including two background samples were collected from the Pawtuxet River. The samples were analyzed for metals, VOCs, SVOCs and PCBs. Figure 2 is a sketch of the site showing the approximate location of the sediment samples. The results of the analyses show detection of arsenic; cadmium; chromium; acetone; benzo(a)anthracene; chrysene; chlorobenzene; dichlorobenzene; methylene chloride; methyl ethyl ketone; pyrene; toluene and xylene at concentrations significantly greater than background concentrations. The results of the sampling are discussed and presented in the results section of this report. The certificates of analysis for this sampling are included in Appendix 4.

### **6.3 SOIL EXPOSURE PATHWAY**

There are seven residences, along Pontiac Avenue, approximately 70-100 feet northwest of the western edge of the landfill (Chatterton, 1993d). Approximately 471 people live within 0.25 miles of the site. Presently there are no workers on site. The nearest worker is at the transfer station located on the same property. No schools, day care centers, terrestrial sensitive environments or resources were identified within the area of the site.

In March 1988, nineteen soil and/or auto-fluff samples were collected from the site. Eleven of the samples showed concentrations greater than or equal to 1 ppm. The concentrations of PCBs in the eleven samples ranged from 1 ppm to 178 ppm. Samples were also collected from lots in the vicinity of the landfill. PCBs were detected at 5 ppm, 21 ppm and 24 ppm in three of the lots with residences, and a concentration of 149 ppm was detected in loose fluff collected from a baseball field. A synthetic 20 ml cap was installed on the entire area of the landfill to cover all exposed PCB-contaminated foam material. Foam material that had migrated from the landfill to surrounding areas was cleaned (RIDEM/DAHM; 1988a).

Soil samples were not collected at the site as part of the ESI. During 1993 and 1994 visits to the site several areas of reddish stained soil were observed throughout the landfill. In 1993 RIDEM/DSR personnel visited the site to observe groundwater sampling. At this time protrusions of the cap along the toe of the landfill were noted. During a 1994 site inspection, reddish stained soil was observed in the southernmost corner of the site outside the fenced area. An empty, rusted drum was observed in the vicinity of the stained soil within the fenced area.

Access to the site can be gained through two locked gates situated along Pontiac Avenue. The area of the property where the landfill is located is surrounded by a chain link fence

The area of the property where the landfill is located is surrounded by a chain link fence that prevents access and use of the site for recreational purposes. However, the area of the Pawtuxet floodplain, east of the site, does appear to be used for recreational purposes (Chatterton, 1993d).

#### 6.4 AIR PATHWAY

Land use in the vicinity of the site is mostly high density residential. The majority of the populations of Cranston and Warwick reside within four miles of the site. Table 8 shows the population estimates for different distance categories. Estimates of the areal extent of wetlands within four miles of the site are presented in Table 9. The nearest sensitive environment is approximately 0.75 miles south of the site (RIGIS, 1992c).

In 1993 RIDEM personnel visited the site. At the time of the inspection passive gas vents were observed along Pontiac Avenue. The vents were not capped, and gas was allowed to release into the atmosphere. PCBs warning labels were noted on the vents. In 1994 the passive gas vents along Pontiac Avenue were connected to the gas recovery system at the landfill.

When RIDEM/DSR personnel visited the site to observe groundwater sampling in 1993 a strong chemical odor was noticed in the vicinity of the leachate collection tanks. In December of 1994, at the time sediment samples were collected, a chemical odor was again noted in the vicinity of the leachate collection tanks.

**Table 8**  
**Estimated Population Within Four Miles of**  
**Cranston Sanitary Landfill**

Radial Distance From Cranston Sanitary Landfill (miles)	Estimated Population
0.00 to < 0.25	471
0.25 to < 0.50	1,163
0.50 to < 1.00	5,472
1.00 to < 2.00	33,184
2.00 to < 3.00	37,166
3.00 to < 4.00	56,224
<b>TOTAL</b>	<b>133,680</b>

(Chatterton, 1994a)

**Table 9**  
**Estimated Wetlands Acreage Within Four Miles of**  
**Cranston Sanitary Landfill**

Radial Distance From Cranston Sanitary Landfill (miles)	Estimated Wetlands Acreage
0.00 < 0.25	37.5
0.25 < 0.50	22.5
0.50 < 1.00	40
1.00 < 2.00	265
2.00 < 3.00	573
3.00 < 4.00	723
<b>TOTAL</b>	<b>1,660</b>

(RIGIS, 1992b; RIGIS, 1992c)

## 7. RESULTS

In 1980 the installation of a leachate collection system at the landfill was completed. The leachate collection tanks and drains were designed to intercept and store surface runoff and surficial groundwater runoff from the landfill. In order to determine the requirements for the proper disposal of leachate, samples were collected from the tanks. In 1982, LPAI collected a sample which was analyzed for metals, VOCs, pH, specific conductance, chloride, total organic carbon (TOC) and iron. Table 10 shows the results of the analysis of the 1982 sample. From 1985 to the present the leachate collection tanks have been sampled quarterly along with the monitoring wells at the site. A summary of the sampling results for the leachate collection tanks is included in Appendix 3.

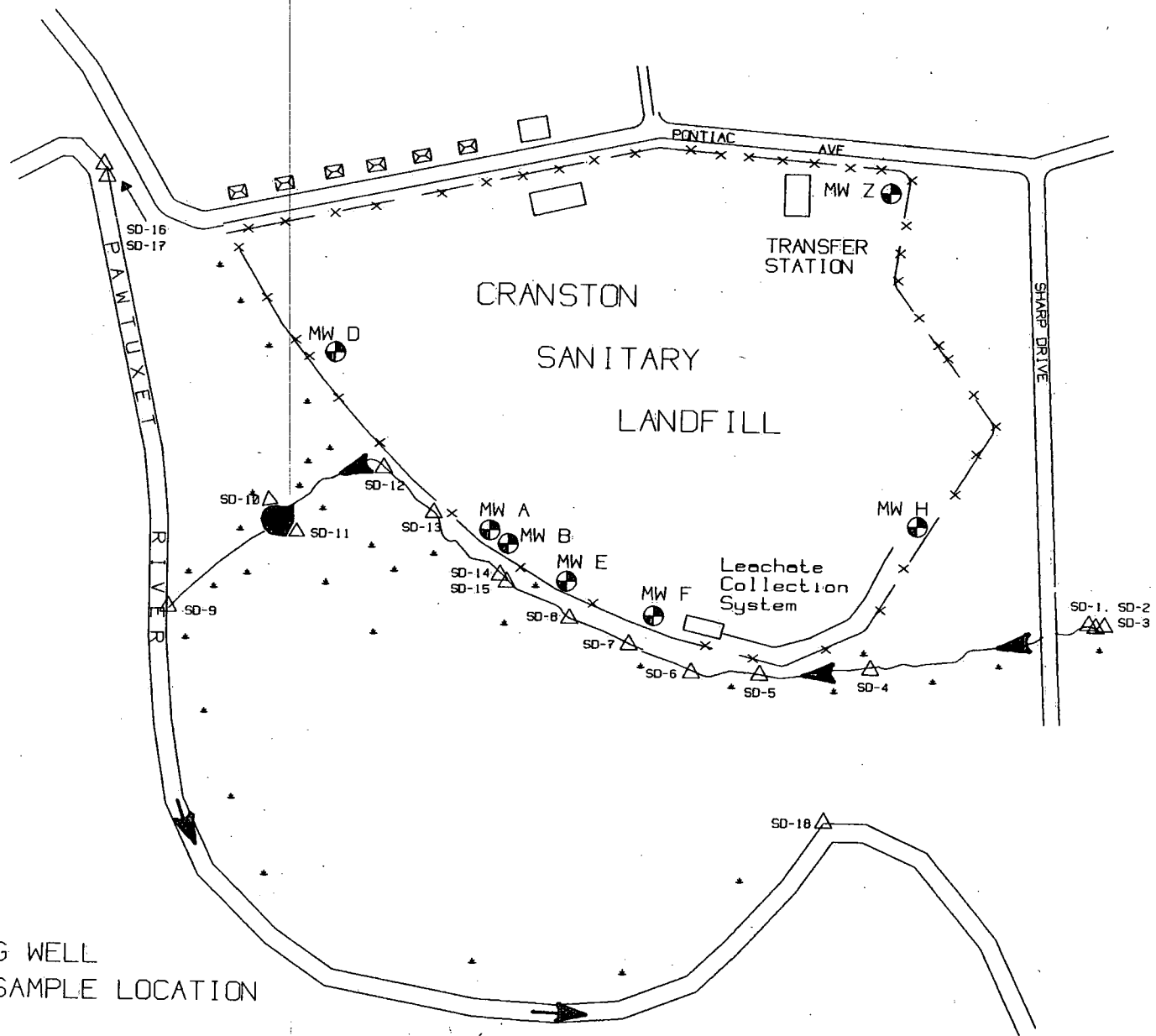
Monitoring wells were first installed at the site in 1977 after the State (Rhode Island) Rules and Regulations for Solid Waste Management Facilities became effective. These regulations required that samples be collected from each of these wells and analyzed by a certified laboratory at least once every three months. From 1977 till 1979 samples were analyzed for specific conductance, pH, temperature, chloride, iron, color, turbidity and COD. Beginning in 1979 analysis of groundwater samples was expanded to include chrome, copper, iron, nickel and zinc. In the mid 1980's analysis of groundwater samples for metals and VOCs began. Records of groundwater sampling from 1986 through 1993 show arsenic; barium;

cadmium; lead; selenium; silver; benzene; chlorobenzene; 1,4-dioxane; ethyl benzene and toluene at concentrations significantly greater than background. Of these substances, manifests document the disposal of cadmium; silver; benzene; chlorobenzene; dioxane and toluene. Of the detected non manifested constituents, arsenic, barium and ethyl benzene were detected in the 1982 sample from the leachate collection system. A summary description of the monitoring wells at the site is presented in Table 11a. The results of the 1993 sampling showed detection of benzene, chlorobenzene, ethylbenzene and toluene at concentrations greater than the corresponding Maximum Contaminant Levels (MCLs). The results of the analysis of the 18 August, 1993 groundwater sampling are presented in Table 11b. The quarterly groundwater monitoring results from 1986 to 1993 are presented in Appendices 1 and 2.

On 14, 15 and 16 December, 1993, RIDEM/DSR personnel collected sediment samples from surface water bodies in the vicinity of the site. A total of 14 sediment samples, including 3 background samples and a duplicate, were collected from the unnamed stream adjacent to the landfill. The 3 background samples were collected upstream of Sharp Drive within 60-70 feet of the road. A total of 9 samples were collected along the reach of the stream that abuts the landfill. In addition, 2 sediment samples were collected in the one-quarter acre pond into which the unnamed stream discharges. A total of four sediment samples, including two background samples, were collected along the Pawtuxet River. A summary of the relative locations of the samples is presented in Table 12a. The samples were analyzed for metals, SVOCs, VOCs and PCBs. The analysis showed arsenic; cadmium; chromium; acetone; chlorobenzene; chrysene; benzo(a)anthracene; dichlorobenzene; methylene chloride; pyrene; methyl ethyl ketone; toluene; xylene and aroclors 1248 and 1254. Of these constituents, manifests document the disposal of acetone; cadmium; chlorobenzene; methylene chloride; pyrene; toluene and xylene. Of the detected non-manifested constituents, arsenic, cadmium, chromium and methyl ethyl ketone were detected in the 1982 sample from the leachate collection system. The disposal of polychlorinated biphenyls at the landfill is documented. The results of the analysis of the December, 1993, sediment sampling are presented in Table 12b. The certificates of analysis for this sampling are included in Appendix 4.

Figure 6 is a sketch of the site showing the relative locations of the monitoring wells and the 1993 sediment samples.

In March 1988, nineteen soil samples were collected from the site, eleven of which showed concentrations greater than or equal to 1 ppm. The concentrations of PCBs in the eleven samples ranged from 1 ppm to 178 ppm. Samples were also collected from lots in the vicinity of the landfill. PCBs were detected at 5 ppm, 21 ppm and 24 ppm in three of the lots with residences and of 149 ppm in loose fluff collected from a baseball field.



LEGEND

- ⊕ MONITORING WELL
- △ SEDIMENT SAMPLE LOCATION
- x-x FENCE
- ▣ RESIDENCE
- STREAM
- POND

NOT TO SCALE

RIDEM/ DIV. OF SITE REMEDIATION  
FIGURE 6: SEDIMENT SAMPLING AND  
MONITORING WELL LOCATIONS  
CRANSTON SANITARY LANDFILL

**Table 10**

**Summary of Analytical Results:  
1982 Leachate Collection System Sample Collected by  
Lee Pare Engineering**

Sample Loc. ID.	Compound/ Element	Conc.
Leachate Collection North East slope of the landfill	Arsenic	7.35 ppm
	Barium	2.21 ppm
	Cadmium	0.079 ppm
	Chromium	0.121 ppm
	Lead	0.737 ppm
	Mercury	0.427 ppm
	Selenium	2.89 ppm
	Benzene	1,500 ppb
	Chlorobenzene	2,000 ppb
	Toluene	5,000 ppb
	Ethyl benzene	1,000 ppb
	Acetone	13,000 ppb
	Isopropyl alcohol	3,000 ppb
	Tetrahydrofuran	15,000 ppb
	Methyl ethyl ketone	20,000 ppb
	Butanol	6,000 ppb
	Dimethyl butane	1,500 ppb
	Diisopropyl ether	3,500 ppb
	Methyl isobutyl ketone	5,000 ppb
	Hexanol	2,000 ppb
	Dimethyl benzene	800 ppb
	Chloride	1,973 ppm
	TOC	1,679 ppm
	Iron	444 ppm
	pH	6.6
	Specific Conductance	1,949 microSeimens/cm

ppb = Parts per billion.  
ppm = Parts per million.

(NETL, 1981-1994)

Table 11a (continued)

18 August, 1993, Sample Summary: Cranston Sanitary Landfill  
Groundwater Samples Collected by  
New England Testing Lab

Well Identification No.	Screen Interval (FT)	Location	Analytical Parameters
<b>MATRIX: Groundwater</b>			
MW-E	---	Along the toe of the landfill, south-eastern boundary of the landfill, between wells A/B and F. Substituted Well 1-78. Used to establish ground water migration of contaminants.	VOC, Filtered metals, pH, Specific Conductance, Chlorides, TOC, Iron
MW-F	---	Along the toe of the landfill, eastern boundary of the landfill, northeast of well E. Substituted Well 2-78. Used to establish ground water migration of contaminants.	VOC, Filtered metals, pH, Specific Conductance, Chlorides, TOC, Iron
MW-H	---	Along the toe of the landfill, north-eastern boundary of the landfill. North of Well F. Used to establish ground water migration of contaminants.	VOC, Filtered metals, pH, Specific Conductance, Chlorides, TOC, Iron
MW-Z	---	Along Pontiac Avenue within transfer station. Northernmost Well. Background groundwater quality	VOC, Filtered metals, pH, Specific Conductance, Chlorides, TOC, Iron

Notes:

VOC = volatile organic compound

TOC = total organic carbon

(Chatterton, 1993b; Guild, 1978, 1980 and 1989)

Table 11b

**Summary of Groundwater Analytical Results:  
Groundwater Samples Collected by  
New England Testing Lab (08/18/93)**

Sample Loc. ID.	Compound/Element	Conc.	Bckgnd Conc.	MCL or ACL	Number of Times Above Background
MW-A	Arsenic	0.011 ppm	<0.005 ppm	0.05 ppm	>2.2 x BCK
	Barium	0.15 ppm	<0.1 ppm	2 ppm	>1.5 x BCK
	Benzene	1,550 ppb	1.9 ppm	0.005 ppm	816 x BCK
	Chlorobenzene	11,900 ppb	<1 ppb	0.1 ppm	>11,900 x BCK
	1,4-Dioxane	20,600 ppb	<20 ppb	---	>1,030 x BCK
	Ethylbenzene	112 ppb	<1 ppb	0.7 ppm	>112 x BCK
	Xylene (total)	495 ppb	1 ppb	10 ppm	>495 BCK
MW-B	Barium	0.27 ppm	<0.10 ppm	2 ppm	>2.7 x BCK
	Benzene	250 ppb	1.9 ppb	0.005 ppm	131.6 x BCK
	Chlorobenzene	3,920 ppb	<1 ppb	0.1 ppm	>3,920 x BCK
	1,4-Dioxane	29,800 ppb	<20 ppb	---	>1,490 x BCK
	Xylene (total)	290 ppb	<1 ppb	10 ppm	>290 x BCK
MW-D	Arsenic	0.01 ppm	<0.005 ppm	0.05 ppm	>2 x BCK
	Barium	0.42 ppm	<0.1 ppm	2 ppm	>4.2 x BCK
	1,4-Dioxane	21,900 ppb	<20 ppb	---	>1,095 x BCK
	Xylene (total)	340 ppb	<1 ppb	10 ppm	>340 x BCK
MW-E	Arsenic	0.039 ppm	<0.005 ppm	0.05 ppm	>7.8 x BCK
	Barium	0.74 ppm	<0.1 ppm	2 ppm	>7.4 x BCK
	Benzene	330 ppb	1.9 ppm	0.005 ppm	>173.7 x BCK
	Chlorobenzene	5,200 ppb	<1 ppb	0.1 ppm	>5,200 x BCK
	1,4-Dioxane	4,800 ppb	<20 ppb	---	>240 x BCK
	Xylene (total)	102 ppb	<1 ppb	10 ppm	>102 x BCK
MW-H	Barium	0.11 ppm	<0.1 ppm	2 ppm	>1.1 x BCK
	Benzene	1,030 ppb	1.9 ppm	0.005 ppm	542 x BCK
	Chlorobenzene	3,800 ppb	<1 ppb	0.1 ppm	>3,800 x BCK
	1,4-Dioxane	6,400 ppb	<20 ppb	---	>320 x BCK
	Ethylbenzene	1,020 ppb	<1 ppb	0.7 ppm	>1,020 x BCK
	Toluene	3,900 ppb	<1 ppb	1 ppm	>3,900 x BCK
	1,2,4-Trimethyl benzene	570 ppb	<1 ppb	---	>570 x BCK
	1,3,5-Trimethyl benzene	140 ppb	<1 ppb	---	>140 x BCK
	Xylene (total)	3,200 ppb	<1 ppb	10 ppm	>3,200 x BCK

## Notes:

ppb = Parts per billion.  
 ppm = Parts per million.  
 BCK = Background Concentrations  
 MCL = Maximum Contaminant Level  
 ACL = Action Contaminant Level

\* For compounds that were not detected in the background sample a comparison was made to the reporting limit.

(NETL, 1981-1994; USEPA, 1994)

Table 12a

**Sample Summary: Cranston Sanitary Landfill  
Sediment Samples Collected by RIDEM/DSR on 14 December, 1993**

Sample Location No.	Depth Interval Sampled (FT)	Objective/Spatial Location	Analytical Parameters
<b>MATRIX: SEDIMENT</b>			
SD-1	0-2	Background concentrations to samples collected along unnamed stream, upstream of Sharp Drive.	VOC, SVOC, Metals, PCB
SD-2	0-2	Background concentrations to samples collected along unnamed stream, upstream of Sharp Drive, approx. 20 ft upstream from SD-1 location.	VOC, SVOC, Metals, PCB
SD-3	0-2	Background concentrations to samples collected along unnamed stream, upstream of Sharp Drive, approx. 10 ft upstream from SD-2 location.	VOC, SVOC, Metals, PCB
SD-4	0-2	Establish release of contaminants to surface water. Located approx. 200 ft upstream of PVC pipe, 112 ft down gradient of SD-5.	VOC, SVOC, Metals, PCB
SD-5	0-2	Establish release of contaminants to surface water. Located approx. 312 ft upstream of PVC pipe, 112 ft upstream of SD-4.	VOC, SVOC, Metals, PCB
SD-6	0-2	Establish release of contaminants to surface water. Located next to PVC pipe, 312 downstream of SD-5.	VOC, SVOC, Metals, PCB
SD-7	0-2	Establish release of contaminants to surface water. Located 110 ft downstream of PVC pipe and SD-6.	VOC, SVOC, Metals, PCB
SD-8	0-2	Establish release of contaminants to surface water. Located 260 ft downstream of PVC pipe and SD-6, 150 ft downstream from SD-7.	VOC, SVOC, Metals, PCB

## Notes:

PCB = Polychlorinated Biphenyls

VOC = volatile organic compound

SVOC = semivolatile organic compound

(Chatterton, 1993d)

Table 12a (continued)

**Sample Summary: Cranston Sanitary Landfill**  
**Sediment Samples Collected by RIDEM/DSR on 15 December, 1993**

Sample Location No.	Depth Interval Sampled (FT)	Objective/Spatial Location	Analytical Parameters
<b>MATRIX: SEDIMENT</b>			
SD-10	0-2	Establish release of contaminants to surface water. Located approx. on northwestern portion of the 1/4 acre pond.	VOC, SVOC, Metals, PCB
SD-11	0-2	Establish release of contaminants to surface water. Located approx. on area where the unnamed stream meets the 1/4 acre pond.	VOC, SVOC, Metals, PCB
SD-12	0-2	Establish release of contaminants to surface water. Located approx. 900 ft downstream of PVC pipe.	VOC, SVOC, Metals, PCB
SD-13	0-2	Establish release of contaminants to surface water. Located approx. 700 ft downstream of PVC pipe.	VOC, SVOC, Metals, PCB
SD-14	0-2	Establish release of contaminants to surface water. Located approx. 490 ft downstream of PVC pipe.	VOC, SVOC, Metals, PCB
SD-15	0-2	Establish release of contaminants to surface water. Located next to PVC pipe, 312 ft downstream of SD-5.	VOC, SVOC, Metals, PCB

## Notes:

SVOC = semivolatile organic compound

TAL = target analyte list

TPH = total petroleum hydrocarbons

VOC = volatile organic compound

(Chatterton, 1993d)

**Table 12a (continued)**

**Sample Summary: Cranston Sanitary Landfill  
Sediment Samples Collected by RIDEM/DSR on 15 and 16 December, 1993**

Sample Location No.	Depth Interval Sampled (FT)	Objective/Spatial Location	Analytical Parameters
<b>MATRIX: SEDIMENT</b>			
SD-16	0-2	Background concentrations to samples collected along the Main Branch of the Pawtuxet River, sample collected upstream of the landfill in the area where Pawtuxet River and Pontiac Avenue approach each other.	VOC, SVOC, Metals, PCB
SD-17	0-2	Background concentrations to samples collected along the Main Branch of the Pawtuxet River, sample collected upstream of the landfill in the area where Pawtuxet River and Pontiac Avenue approach each other.	VOC, SVOC, Metals, PCB
SD-9	0-2	Establish release of contaminants to surface water. Collected in the vicinity where the unnamed stream meets the Main Branch of the Pawtuxet River.	VOC, SVOC, Metals, PCB
SD-18	0-2	Establish release of contaminants to surface water. Collected in the Pawtuxet River approximately 1000 feet downstream from where the unnamed stream meets the Pawtuxet River.	VOC, SVOC, Metals, PCB

**Notes:**

SVOC = semivolatile organic compound

TAL = target analyte list

TPH = total petroleum hydrocarbons

VOC = volatile organic compound

(Chatterton, 1993d)

Table 12b

**Summary of Analytical Results  
Sediment Sample Analysis for  
Cranston Sanitary Landfill**

Sample Location No.	Compound/ Element	Concentration	Background concentration	Comments
SD-4	Chrysene Pyrene	481 ppb 2830 ppb	<330 ppb 941.3 ppb	>BCKGND 3 x BCKGND
SD-5	Benzo(a)anthracene Chrysene	568 ppb 981 ppb	<330 ppb <330 ppb	>1.7 x BCKGND >3 x BCKGND
SD-6	Acetone Chlorobenzene Dichlorobenzene Methylene chloride Methyl ethyl ketone Toluene Xylene Arochlor 1248 Arochlor 1254	591 ppb 309 ppb 219 ppb 8 ppb 85 ppb 9 ppb 903 ppb 7 ppm 5 ppm	197 ppb <5 ppb <10 ppb <5 ppb <50 ppb <5 ppb <10 ppb <1 ppm <1 ppm	3 x BCKGND >61.8 x BCKGND >21.9 x BCKGND >1.6 x BCKGND >1.7 x BCKGND >1.8 x BCKGND >90.3 x BCKGND >7 x BCKGND >5 x BCKGND
SD-7	Chlorobenzene	29 ppb	<5 ppb	>5.8 x BCKGND
SD-8	Chlorobenzene Methylene chloride	23 ppb 10 ppb	<5 ppb <5 ppb	>4.6 x BCKGND >2 x BCKGND
SD-9*	Chlorobenzene	18 ppb	<5 ppb	>3.6 x BCKGND
SD-10	Arsenic Chromium Chlorobenzene	8 ppm 17 ppm 70 ppb	2 ppm 5.3 ppm <5 ppb	4 x BCKGND 3 x BCKGND >14 x BCKGND
SD-13	Chlorobenzene Methylene chloride	19 ppb 12 ppb	<5 ppb <5 ppb	>3.8 x BCKGND >2.4 x BCKGND
SD-18*	Cadmium Chromium Chlorobenzene	19 ppm 840 ppm 69 ppb	2.5 ppm 97 ppm <5 ppb	7.6 x BCKGND 8.6 x BCKGND >13.8 x BCKGND

## Notes:

BCKGND = Background concentration

ppb = Parts per billion.

ppm = Parts per million.

NOTE: The background concentrations were calculated by averaging the concentrations of the constituents in the background samples.  
 \* For samples SD-9 and SD-18 (samples taken along the Pawtuxet), two background samples were collected. For the remaining of the samples (collected along the unnamed stream) three background samples were collected.

(Chatterton, 1993d; ESS, 1993)

## 8. SUMMARY

The Cranston Sanitary Landfill is located on a lot comprised of 47.2 acres in the City of Cranston, R.I.. In the 1970's the landfill started accepting industrial wastes. In 1978 CSL began manifesting all hazardous materials disposed of at the site. In October of 1979 CSL ceased acceptance and landfilling of hazardous waste. Landfilling operations continued until 1985 when the landfill accepted refuse for the last time. In 1988 RIDEM discovered that CSL had disposed of refuse and hazardous waste at the site after its closure.

Land uses in the vicinity of the landfill were determined from aerial photographs of the site and its vicinity. The photographs indicate that the predominant land uses within 0.25 miles of the site are high density commercial and residential development, and wetlands. The site is characterized by generally high topographic relief, with a difference in elevation between the toe and the highest point in the landfill of approximately 90 ft. The property is occupied by a transfer station, a building surrounded by a paved area, a large mound of refuse approximately 43 acres in extent and a dirt road that runs along the southeastern boundary of the landfill. The landfilled area is covered with two 20 ml synthetic caps and a grass vegetative cover. This cover and drainage channels, installed in 1990, were designed to minimize erosion of the clean fill that covers the second cap. However, partial erosion of the clean fill can be observed on the faces of the landfill.

The USGS surficial geology map of the East Greenwich Quadrangle indicates that a variety of surficial deposits including kame terraces, ground moraine, alluvium and river terrace deposits occupied the site and its vicinity. Driller's logs from the installation of monitoring wells at the landfill indicate a thickness of overburden that varies between 10 and 50 feet. Small soil units located within the landfill are described as well-drained, and the permeability of these soils is moderate to moderately rapid. Well logs indicate that bedrock described as shale was reached at 42 feet.

The groundwater classification on the site is GB. The use of groundwater resources within four miles of the site is very limited. Major portions of the populations of Cranston and Warwick and parts of the populations of West Warwick and Providence reside within four miles of the landfill. The majority of the residents in these cities obtain their water from public sources, but small percentages of these residents use private water wells. Approximately 1,527 people obtain their water from groundwater resources within 4 miles of the site. The location of the nearest private well is approximately 1.5 miles from the site. There are five WHPAs within four miles of Cranston Sanitary Landfill. The nearest WHPA, located approximately 2 miles from the site in a direction of 10° south of west, is the WHPA of a transient non-community water well.

Groundwater flow in the area of the site is in an easterly and southeasterly direction toward an unnamed stream and associated wetlands located adjacent to the site. The area recharging the site's groundwater is apparently limited to the extent of the landfill.

Cross-sectional plots of the site indicate the presence of refuse below the groundwater table. The location of hazardous waste sources relative to the water table has not been determined. However, sampling of monitoring wells at the site has revealed migration of contaminants to the groundwater. Analysis of samples collected from these wells in 1993 showed arsenic; barium; benzene; chlorobenzene; 1,4-dioxane; ethyl benzene; toluene; 1,2,4-trimethylbenzene; 1,3,5-trimethylbenzene and total xylene at concentrations greater than three times the background concentrations.

The site is on a surface water divide, in a greater-than-five-hundred-year flood-plain within the watershed of the Main Branch of the Pawtuxet River. The site's potential surface run-off path is toward an unnamed stream and wetlands east and south-east of the landfill. The reach of the unnamed stream adjacent to the landfill is approximately 1,500 feet long. Downgradient of this reach the stream turns southeast, away from the landfill, and flows into a one-quarter-acre pond. A stream approximately 50 feet long connects the pond to the Main Branch of the Pawtuxet River. The flow path in the Pawtuxet River is approximately 5.0 miles before entering Pawtuxet Cove. The flow path in the Pawtuxet Cove is approximately 0.5 miles before entering the Providence River. The Providence River is a tidal surface water body, and the entire length of the river is within the surface water pathway of the site. The upstream portion of the surface water pathway, from Pawtuxet Cove, includes 4.2 miles of the Providence River and 4.2 miles of the Seekonk River. Other tidally influenced surface water bodies located upstream of Pawtuxet Cove and within the 15 mile surface water pathway of the site include Watchemocket Cove and the lower reaches of the Woonasquatucket River. The downstream portion of the surface water pathway, from Pawtuxet Cove includes 3.33 miles of the Providence River and 5 miles of Narragansett Bay. Once in Narragansett Bay the surface water pathway will include all tidal surface water bodies that fall within the 15 mile target distance limit of the site. These surface water bodies include but are not limited to: Greenwich Bay, Hope Bay, and the Barrington, Palmer and Warren Rivers.

The total frontage of wetlands along the pathway is approximately 7.5 miles. Along the surface water pathway of Cranston Sanitary Landfill there are a number of sensitive environments, including Hog Island and the Palmer River. Narragansett Bay, an estuary identified under the National Estuary Program, is a major fishery in the state of Rhode Island.

In 1993, RIDEM/DSR personnel collected sediment samples from surface water bodies in the vicinity of the site. The samples were analyzed for metals, VOCs, SVOCs and PCBs. The results of the analyses show arsenic; cadmium; chromium; acetone; benzo(a)anthracene; chrysene; chlorobenzene; dichlorobenzene; methylene chloride; methyl ethyl ketone; pyrene; toluene and xylene at concentrations significantly greater than background concentrations.

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**APPENDIX 1**  
**INORGANIC GROUNDWATER SAMPLING RESULTS**  
**1986-1993**

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# ANALYSIS RESULTS OF INORGANICS, CRANSTON SANITARY LANDFILL, MONITORING WELL F

COMPOUND- DATE	ARSENIC	BARIUM	CADMIUM	CHROMIUM	LEAD	MERCURY	SELENIUM	SILVER
03/20/86	0.66	1	0.01	0.05	0.38	<0.002	0.49	0.04
03/19/87	<0.005	0.1	0.02	<0.02	<0.05	<0.002	0.27	<0.02
12/29/87	<0.005	<0.1	<0.01	<0.02	<0.05	<0.002	<0.005	<0.02
03/01/88	<0.025	0.1	<0.01	<0.02	<0.05	<0.002	<0.015	<0.02
06/14/88	<0.20	0.1	0.01	0.02	0.07	<0.002	<0.05	<0.02
10/06/88	<0.005	<0.1	0.03	0.02	<0.05	<0.002	<0.25	<0.02
07/25/89	0.043	<0.1	<0.01	<0.02	<0.05	<0.002	<0.005	<0.02
10/12/89	<0.050	0.57	0.01	<0.02	<0.05	<0.002	<0.025	<0.02
01/18/90	0.042	0.39	0.02	<0.02	0.12	<0.002	<0.005	<0.02
04/17/90	0.073	0.71	0.02	<0.02	0.11	<0.002	<0.01	<0.02
07/26/90	0.047	<0.5	0.02	<0.02	0.07	<0.002	<0.005	<0.02
10/25/90	0.058	0.55	0.02	0.02	0.15	<0.002	<0.005	<0.02
01/31/91	0.021	<0.5	<0.02	<0.02	0.12	<0.002	<0.005	<0.02
04/23/91	0.015	<0.5	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
07/15/91	0.023	0.55	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
10/10/91	0.02	<0.5	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
01/24/92	0.024	0.34	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
04/23/92	0.072	0.38	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
07/21/92	0.054	0.3	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
11/05/92	0.03	0.28	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
01/26/93	0.009	0.26	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
04/20/93	---	---	---	---	---	---	---	---

## ANALYSIS RESULTS OF INORGANICS, CRANSTON SANITARY LANDFILL, MONITORING WELL 2-78

COMPOUND- DATE	ARSENIC	BARIUM	CADMIUM	CHROMIUM	LEAD	MERCURY	SELENIUM	SILVER
03/20/86	0.29	1.3	<0.01	0.04	0.22	<0.002	0.24	0.05
03/19/87	---	---	---	DISMANTLED WELL?		---	---	---
				SUBSTITUTED BY WELL F				

NOTE: ALL CONCENTRATIONS ARE PRESENTED IN PARTS PER MILLION (PPM)

ANALYSIS RESULTS OF INORGANICS, CRANSTON SANITARY LANDFILL, MONITORING WELL E

COMPOUND- DATE	ARSENIC	BARIUM	CADMIUM	CHROMIUM	LEAD	MERCURY	SELENIUM	SILVER
06/14/88	----			PRIOR TO THIS DATE				----
10/06/88	----			WELL 1-78 WAS USED				----
07/25/89	0.048	1.55	<0.01	<0.02	<0.05	<0.002	<0.005	<0.02
10/12/89	<0.05	1.7	0.01	<0.02	0.12	<0.002	<0.025	<0.02
01/18/90	0.042	1.3	0.02	<0.02	0.09	<0.002	<0.005	<0.02
04/17/90	0.031	1.6	0.01	<0.02	0.1	<0.002	<0.01	<0.02
07/26/90	0.024	1.1	<0.02	<0.02	0.07	<0.002	<0.005	<0.02
10/25/90	0.029	1.2	<0.02	<0.02	0.17	<0.002	<0.005	<0.02
01/31/91	0.018	1.1	<0.02	<0.02	0.13	<0.002	<0.005	<0.02
04/23/91	<0.005	0.98	<0.02	<0.02	0.12	<0.002	<0.005	<0.02
07/15/91	0.018	1.06	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
10/10/91	0.007	0.93	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
01/24/92	0.028	1.1	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
04/23/92	0.028	0.77	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
07/21/92	0.012	0.59	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
11/05/92	0.015	0.6	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
01/26/93	0.026	0.61	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
04/20/93	0.039	0.74	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02

ANALYSIS RESULTS OF INORGANICS, CRANSTON SANITARY LANDFILL, MONITORING WELL 1-78

COMPOUND- DATE	ARSENIC	BARIUM	CADMIUM	CHROMIUM	LEAD	MERCURY	SELENIUM	SILVER
03/20/86	0.46	0.8	<0.01	0.05	0.24	<0.002	0.32	0.04
03/19/87	<0.005	0.1	0.04	<0.02	<0.05	<0.002	1.4	<0.02
12/29/87	<0.005	0.2	0.01	<0.02	<0.05	<0.002	<0.005	<0.02
03/01/88	<0.01	0.2	0.01	<0.02	<0.05	<0.002	<0.2	<0.02
06/14/88	<0.01	0.3	0.01	<0.02	<0.05	<0.002	<0.02	<0.02
10/06/88	<0.005	<0.1	0.02	<0.02	<0.05	<0.002	<0.25	<0.02
07/25/89	----			DISMANTLED WELL?				----
10/12/89	----			SUBSTITUTED BY WELL E				

NOTE: ALL CONCENTRATIONS ARE PRESENTED IN PARTS PER MILLION (PPM)

ANALYSIS RESULTS OF INORGANICS, CRANSTON SANITARY LANDFILL, MONITORING WELL A

COMPOUND- DATE	ARSENIC	BARIUM	CADMIUM	CHROMIUM	LEAD	MERCURY	SELENIUM	SILVER
06/14/88	---			PRIOR TO THIS DATE				---
10/06/88	---			WELL 3-A WAS USED				---
07/25/89	0.022	<0.1	<0.01	<0.02	<0.05	<0.002	<0.005	<0.02
10/12/89	<0.025	<0.1	0.01	<0.02	0.1	<0.002	<0.025	<0.02
01/18/90	0.012	<0.1	0.02	<0.02	0.1	<0.002	<0.005	<0.02
04/17/90	<0.005	<0.1	0.01	<0.02	<0.05	<0.002	<0.01	<0.02
07/26/90	<0.005	<0.5	0.02	<0.02	0.07	<0.002	<0.005	<0.02
10/25/90	0.011	<0.5	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
01/31/91	<0.005	<0.5	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
04/23/91	<0.005	<0.5	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
07/15/91	<0.005	<0.5	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
10/10/91	<0.005	<0.5	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
01/24/92	0.007	0.14	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
04/23/92	<0.005	<0.1	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
07/21/92	<0.005	<0.1	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
11/05/92	<0.005	<0.1	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
01/26/93	0.008	0.12	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
04/20/93	0.011	0.15	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02

ANALYSIS RESULTS OF INORGANICS, CRANSTON SANITARY LANDFILL, MONITORING WELL 3-A

COMPOUND- DATE	ARSENIC	BARIUM	CADMIUM	CHROMIUM	LEAD	MERCURY	SELENIUM	SILVER
03/20/86	0.1	1.7	0.02	0.02	0.17	<0.002	0.09	0.04
03/19/87	<0.005	0.1	0.04	<0.02	<0.05	<0.002	0.045	<0.02
12/29/87	<0.005	<0.1	<0.01	<0.02	<0.05	<0.002	<0.005	<0.02
03/01/88	0.006	<0.1	<0.01	<0.02	<0.05	<0.002	<0.015	<0.02
06/14/88	<0.005	0.2	0.01	<0.02	<0.05	<0.002	<0.02	<0.02
10/06/88	---			DESTROYED WELL?				---
07/25/89	---			SUBSTITUTED BY WELL A				---

NOTE: ALL CONCENTRATIONS ARE PRESENTED IN PARTS PER MILLION (PPM)

ANALYSIS RESULTS OF INORGANICS, CRANSTON SANITARY LANDFILL, MONITORING WELL B

COMPOUND- DATE	ARSENIC	BARIUM	CADMIUM	CHROMIUM	LEAD	MERCURY	SELENIUM	SILVER
06/14/88	----			PRIOR TO THIS DATE				----
10/06/88	----			WELL B DID NOT EXIST				----
07/25/89	0.013	<0.1	<0.01	<0.02	<0.05	<0.002	<0.005	<0.02
10/12/89	<0.025	<0.1	0.01	<0.02	0.11	<0.002	<0.025	<0.02
01/18/90	0.006	0.36	0.02	<0.02	0.06	<0.002	<0.005	<0.02
04/17/90	<0.005	0.61	0.02	<0.02	0.1	<0.002	<0.01	<0.02
07/26/90	<0.005	<0.5	0.02	<0.02	0.09	<0.002	<0.005	<0.02
10/25/90	<0.005	<0.5	0.02	<0.02	0.18	<0.002	<0.005	<0.02
01/31/91	<0.005	<0.5	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
04/23/91	<0.005	<0.5	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
07/15/91	<0.005	<0.5	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
10/10/91	<0.005	<0.5	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
01/24/92	0.007	0.27	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
04/23/92	<0.005	0.27	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
07/21/92	<0.005	0.22	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
11/05/92	<0.005	0.23	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
01/26/93	0.006	0.32	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
04/20/93	<0.005	0.27	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02

NOTE: ALL CONCENTRATIONS ARE PRESENTED IN PARTS PER MILLION (PPM)

# ANALYSIS RESULTS OF INORGANICS, CRANSTON SANITARY LANDFILL, MONITORING WELL D

COMPOUND- DATE	ARSENIC	BARIUM	CADMIUM	CHROMIUM	LEAD	MERCURY	SELENIUM	SILVER
06/14/88	----			PRIOR TO THIS DATE				----
10/06/88	----			WELL D DID NOT EXIST				----
07/25/89	0.02	<0.1	<0.01	<0.02	<0.05	<0.002	<0.005	<0.02
10/12/89	<0.025	0.32	<0.01	<0.02	0.06	<0.002	<0.025	<0.02
01/18/90	0.013	0.34	0.01	<0.02	0.07	<0.002	<0.005	<0.02
04/17/90	<0.005	0.52	0.01	<0.02	<0.05	<0.002	<0.01	<0.02
07/26/90	0.005	<0.5	<0.02	<0.02	<0.05	<0.002	<0.005	<0.02
10/25/90	0.009	<0.5	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
01/31/91	<0.005	<0.5	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
04/23/91	<0.005	<0.5	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
07/15/91	<0.005	<0.5	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
10/10/91	<0.005	<0.5	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
01/24/92	0.007	0.3	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
04/23/92	<0.005	0.24	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
07/21/92	<0.005	0.21	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
11/05/92	<0.005	0.23	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
01/26/93	0.009	0.29	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
04/20/93	0.01	0.42	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02

NOTE: ALL CONCENTRATIONS ARE PRESENTED IN PARTS PER MILLION (PPM)

# ANALYSIS RESULTS OF INORGANICS, CRANSTON SANITARY LANDFILL, MONITORING WELL C

COMPOUND- DATE	ARSENIC	BARIUM	CADMIUM	CHROMIUM	LEAD	MERCURY	SELENIUM	SILVER
06/14/88	----			PRIOR TO THIS DATE				----
10/06/88	----			WELL C DID NOT EXIST				----
07/25/89	0.019	<0.1	<0.01	<0.02	<0.05	<0.002	<0.005	<0.02
10/12/89	<0.025	<0.1	0.01	<0.02	0.05	<0.002	<0.025	<0.02
01/18/90	0.011	<0.1	0.01	<0.02	0.15	<0.002	<0.005	<0.02
04/17/90	<0.005	0.16	0.01	<0.02	<0.05	<0.002	<0.01	<0.02
07/26/90	<0.005	<0.5	<0.02	<0.02	<0.05	<0.002	<0.005	<0.02
10/25/90	<0.005	<0.5	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
01/31/91	----			WELL WAS DESTROYED				----

NOTE: ALL CONCENTRATIONS ARE PRESENTED IN PARTS PER MILLION (PPM)

ANALYSIS RESULTS OF INORGANICS, CRANSTON SANITARY LANDFILL, MONITORING WELL 3-78

COMPOUND- DATE	ARSENIC	BARIUM	CADMIUM	CHROMIUM	LEAD	MERCURY	SELENIUM	SILVER
03/20/86	0.85	2	0.01	0.03	0.31	<0.002	0.59	0.06
03/19/87	<0.005	0.2	0.03	<0.02	<0.05	<0.002	0.17	<0.02
12/10/87	<0.005	0.1	0.01	<0.02	<0.05	<0.002	<0.005	<0.02
03/01/88	<0.005	0.4	0.01	<0.02	<0.05	<0.002	0.2	<0.02
06/14/88	<0.1	0.4	0.01	0.02	<0.05	<0.002	<0.1	<0.02
10/06/88	<0.005	<0.1	0.04	<0.02	<0.05	<0.002	<0.25	<0.02
04/20/89	<0.05	<0.1	0.01	0.02	<0.05	<0.002	<0.005	<0.02
10/12/89	----			DESTROYED WELL?				----

NOTE: ALL CONCENTRATIONS ARE PRESENTED IN PARTS PER MILLION (PPM)

ANALYSIS RESULTS OF INORGANICS, CRANSTON SANITARY LANDFILL, MONITORING WELL OW-4

COMPOUND- DATE	ARSENIC	BARIUM	CADMIUM	CHROMIUM	LEAD	MERCURY	SELENIUM	SILVER
03/19/87	<0.005	0.3	0.03	<0.02	<0.05	<0.002	0.63	<0.02
12/10/87	<0.016	<0.3	<0.03	<0.06	<0.16	<0.006	<0.016	<0.06
03/01/88	<0.5	0.3	0.01	<0.02	<0.05	<0.002	<0.20	<0.02
06/14/88	----	DESTROYED WELL?						----

NOTE: ALL CONCENTRATIONS ARE PRESENTED IN PARTS PER MILLION (PPM)

ANALYSIS RESULTS OF INORGANICS, CRANSTON SANITARY LANDFILL, MONITORING WELL 4-80

COMPOUND- DATE	ARSENIC	BARIUM	CADMIUM	CHROMIUM	LEAD	MERCURY	SELENIUM	SILVER
03/20/86	0.8	0.8	0.03	0.04	1.48	<0.002	0.61	0.04
03/19/87	<0.005	0.1	0.03	<0.02	<0.05	<0.002	0.28	<0.02
12/10/87	<0.005	0.2	<0.01	<0.02	<0.05	<0.002	<0.005	<0.02
03/01/88	<0.05	<0.1	0.01	<0.02	<0.05	<0.002	<0.1	<0.02
06/14/88	<0.05	0.2	<0.01	<0.02	<0.05	<0.002	<0.05	<0.02
10/06/88	<0.005	<0.1	<0.01	<0.02	<0.05	<0.002	<0.25	<0.02
07/25/89	----			DESTROYED WELL?				----

NOTE: ALL CONCENTRATIONS ARE PRESENTED IN PARTS PER MILLION (PPM)

# ANALYSIS RESULTS OF INORGANICS, CRANSTON SANITARY LANDFILL, MONITORING WELL 4-80

COMPOUND- DATE	ARSENIC	BARIUM	CADMIUM	CHROMIUM	LEAD	MERCURY	SELENIUM	SILVER
03/20/86	0.8	0.8	0.03	0.04	1.49	<0.002	0.61	0.04
03/19/87	<0.005	0.1	0.03	<0.02	<0.05	<0.002	0.28	<0.02
12/29/87	<0.005	0.2	<0.01	<0.02	<0.05	<0.002	<0.005	<0.02
03/01/88	<0.05	<0.1	0.01	<0.02	<0.05	<0.002	<0.1	<0.02
06/14/88	<0.05	0.2	0.01	<0.02	<0.05	<0.002	<0.05	<0.02
10/06/88	<0.005	<0.1	0.04	<0.02	<0.05	<0.002	<0.25	<0.02
04/20/89	<0.025	<0.1	<0.01	<0.02	<0.05	<0.002	<0.005	<0.02
07/25/89	0.014	<0.1	<0.01	<0.02	<0.05	<0.002	<0.005	<0.02

NOTE: ALL CONCENTRATIONS ARE PRESENTED IN PARTS PER MILLION (PPM)

## ANALYSIS RESULTS OF INORGANICS, CRANSTON SANITARY LANDFILL, MONITORING WELL H

COMPOUND- DATE	ARSENIC	BARIUM	CADMIUM	CHROMIUM	LEAD	MERCURY	SELENIUM	SILVER
07/25/89	0.013	<0.1	<0.01	<0.02	<0.05	<0.002	<0.005	<0.02
10/12/89	<0.025	<0.1	<0.01	<0.02	<0.05	<0.002	<0.025	<0.02
01/18/90	<0.005	<0.1	0.01	<0.02	<0.05	<0.002	<0.005	<0.02
04/17/90	0.007	<0.1	0.01	<0.02	0.09	<0.002	<0.01	<0.02
07/26/90	<0.005	<0.5	<0.02	<0.02	0.05	<0.002	<0.005	<0.02
10/25/90	<0.005	<0.5	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
01/31/91	<0.005	<0.5	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
04/23/91	<0.005	<0.5	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
07/15/91	<0.005	<0.5	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
10/10/91	<0.005	<0.5	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
01/24/92	0.005	<0.1	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
04/23/92	<0.005	<0.1	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
07/21/92	<0.005	<0.1	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
11/05/92	<0.005	<0.1	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
01/26/93	<0.005	<0.1	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
04/20/93	<0.005	0.11	<0.02	<0.02	<0.02	<0.1	<0.005	<0.02

NOTE: ALL CONCENTRATIONS ARE PRESENTED IN PARTS PER MILLION (PPM)

ANALYSIS RESULTS OF INORGANICS, CRANSTON SANITARY LANDFILL, MONITORING WELL Z

COMPOUND-> DATE	ARSENIC	BARIUM	CADMIUM	CHROMIUM	LEAD	MERCURY	SELENIUM	SILVER
03/19/87	<0.005	<0.1	0.02	<0.02	<0.05	<0.002	0.024	<0.02
12/29/87	<0.005	<0.1	<0.01	<0.02	<0.05	<0.002	<0.005	<0.02
03/01/88	0.018	<0.1	<0.01	<0.02	<0.05	<0.002	<0.01	<0.02
06/14/88	<0.01	<0.1	0.01	<0.02	<0.05	<0.002	<0.01	<0.02
10/06/88	<0.005	<0.1	<0.01	<0.02	<0.05	<0.002	<0.25	<0.02
04/20/89	<0.005	<0.1	0.02	<0.02	<0.05	<0.002	<0.005	<0.02
07/25/89	0.013	<0.1	<0.01	<0.02	<0.05	<0.002	<0.005	<0.02
10/12/89	<0.025	<0.1	<0.01	<0.02	<0.05	<0.002	<0.025	<0.02
01/18/90	<0.005	<0.1	0.01	<0.02	<0.05	<0.002	<0.005	<0.02
04/17/90	0.007	<0.1	0.01	<0.02	0.09	<0.002	<0.01	<0.02
07/26/90	<0.005	<0.5	<0.02	<0.02	0.05	<0.002	<0.005	<0.02
10/25/90	<0.005	<0.5	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
01/31/91	<0.005	<0.5	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
04/23/91	<0.005	<0.5	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
07/15/91	<0.005	<0.5	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
10/10/91	<0.005	<0.5	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
01/24/92	0.005	<0.1	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
04/23/92	<0.005	<0.1	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
07/21/92	<0.005	<0.1	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
11/05/92	<0.005	<0.1	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
01/26/93	<0.005	<0.1	<0.02	<0.02	<0.1	<0.002	<0.005	<0.02
04/20/93	<0.005	0.11	<0.02	<0.02	<0.02	<0.1	<0.005	<0.02

NOTE: ALL CONCENTRATIONS ARE PRESENTED IN PARTS PER MILLION (PPM)

**APPENDIX 2**  
**ORGANIC GROUNDWATER SAMPLING RESULTS**  
**1986-1993**

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ANALYSIS RESULTS OF ORGANICS, CRANSTON SANITARY LANDFILL, MONITORING WELL F

COMPOUND->	Methylethyl	Trichloroethylene	1,1-	1,2-	Methylisopropyl
DATE	ketone		dichloroethane	dichloroethane	Ketone
03/20/86	<10	<10	<10	<10	<10
03/19/87	<10	<10	<10	<10	<10
12/29/87	<25	<25	<25	<25	<25
03/01/88	<40	<40	<40	<40	<40
06/14/88	84	<10	<10	<10	<10
10/06/88	<30	<30	<30	<30	<30
07/25/89	1947	<80	<80	<80	<80
10/12/89	<500	545	<500	<500	<500
01/18/90	61500	<500	<500	<500	<500
04/17/90	---	<500	<500	<500	---
07/26/90	---	<500	<500	<500	---
10/25/90	---	<500	<500	<500	---
01/31/91	---	<500	<500	<500	---
04/23/91	---	<500	<500	<500	---
07/15/91	---	<500	<500	<500	---
10/10/91	---	<500	<500	<500	---
01/24/92	---	<500	<500	<500	---
04/23/92	---	<100	<100	<100	---
07/21/92	---	<100	<100	<100	---
11/05/92	---	<100	<100	<100	---
01/26/93	---	<100	<100	<100	---
04/20/93	---	---			

NOTE: ALL CONCENTRATIONS ARE PRESENTED IN PARTS PER BILLION (PPB)

# ANALYSIS RESULTS OF ORGANICS, CRANSTON SANITARY LANDFILL, MONITORING WELL D

COMPOUND- DATE	Methylethyl ketone	Trichloroethylene	1,1- dichloroethane	1,2- dichloroethane	Methylisopropyl Ketone
06/14/88	----		PRIOR TO THIS DATE		----
10/06/88	----		WELL D DID NOT EXIST		----
07/25/89	<80	<80	<80	<80	<80
10/12/89	<100	<100	<100	<100	<100
01/18/90	<100	<100	<100	<100	<100
04/17/90	----	<100	<100	<100	----
07/26/90	----	<100	<100	<100	----
10/25/90	----	<100	<100	<100	----
01/31/91	----	<50	<50	<50	----
04/23/91	----	<100	<100	<100	----
07/15/91	----	<100	<100	<100	----
10/10/91	----	<100	<100	<100	----
01/24/92	----	<100	<100	<100	----
04/23/92	----	<100	<100	<100	----
07/21/92	----	<100	<100	<100	----
11/05/92	----	<100	<100	<100	----
01/26/93	----	<100	<100	<100	----
04/20/93					

NOTE: ALL CONCENTRATIONS ARE PRESENTED IN PARTS PER BILLION (PPB)

# ANALYSIS RESULTS OF ORGANICS, CRANSTON SANITARY LANDFILL, MONITORING WELL C

COMPOUND- DATE	Chlorobenzene	Benzene	Toluene	Ethylbenzene	Xylene	Dioxane	Diisopropyl ether
06/14/88	----		PRIOR TO THIS DATE				----
10/06/88	----		WELL C DID NOT EXIST				----
07/25/89	2400	602	<80	<80	88	7536	<80
10/12/89	1862	317	<100	<100	<100	7139	<100
01/18/90	2730	440	185	<100	<100	11100	7500
04/17/90	2802	551	<100	<100	<100	<2000	----
07/26/90	4960	859	<100	117	<100	<2000	----
10/25/90	4050	381	<100	<100	<100	<2000	----
01/31/91	462	50	<50	<50	<50	3580	----

NOTE: ALL CONCENTRATIONS ARE PRESENTED IN PARTS PER BILLION (PPB)

# ANALYSIS RESULTS OF ORGANICS, CRANSTON SANITARY LANDFILL, MONITORING WELL C

COMPOUND- DATE	Isopropyl Alcohol	Tetrahydrofuran	Acetone	Dichlorobenzene	Dichloromethane	Diethyl ether
06/14/88	----		PRIOR TO THIS DATE			----
10/06/88	----		WELL C DID NOT EXIST			----
07/25/89	<80	<80	<80	<80	<80	1235
10/12/89	<100	<100	<100	<100	<100	827
01/18/90	<100	<100	<100	<100	<100	1630
04/17/90	----	----	<1000	<300	----	----
07/26/90	----	----	<1000	<300	----	----
10/25/90	----	----	<1000	<300	----	----
01/31/91	----	----	<500	<150	----	----

NOTE: ALL CONCENTRATIONS ARE PRESENTED IN PARTS PER BILLION (PPB)

# ANALYSIS RESULTS OF ORGANICS, CRANSTON SANITARY LANDFILL, MONITORING WELL C

COMPOUND- DATE	Methylethyl ketone	Trichloroethylene	1,1- dichloroethane	1,2- dichloroethane	Methylisopropyl Ketone
06/14/88	----		PRIOR TO THIS DATE		----
10/06/88	----		WELL C DID NOT EXIST		----
07/25/89	<80	<80	<80	<80	<80
10/12/89	<100	<100	<100	<100	<100
01/18/90	<100	<100	<100	<100	<100
04/17/90	----	<100	<100	<100	----
07/26/90	----	<100	<100	<100	----
10/25/90	----	<100	<100	<100	----
01/31/91	----	<50	<50	<50	----

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NOTE: ALL CONCENTRATIONS ARE PRESENTED IN PARTS PER BILLION (PPB)

ANALYSIS RESULTS OF ORGANICS, CRANSTON SANITARY LANDFILL, MONITORING WELL 3-78

COMPOUND- DATE	Chlorobenzene	Benzene	Toluene	Ethylbenzene	Xylene	Dioxane	Diisopropyl ether
9/30/86	215	73	86	<10	47	5629	<10
03/19/87	45	<10	13	<10	52	59493	500
12/10/87	3305	850	1702	1210	3082	20430	1240
03/01/88	737	<10	825	800	1855	3730	320
06/14/88	15500	496	15500	6210	22770	42000	<30
10/06/88	2120	760	<200	11500	17305	16300	2500
04/20/89	----			WELL DESTROYED			----
10/12/89	----						----

NOTE: ALL CONCENTRATIONS ARE PRESENTED IN PARTS PER BILLION (PPB)

ANALYSIS RESULTS OF ORGANICS, CRANSTON SANITARY LANDFILL, MONITORING WELL 3-78

COMPOUND- DATE	Isopropyl Alcohol	Tetrahydrofuran	Acetone	Dichlorobenzene	Dichloromethane	Diethyl ether
9/30/86	<10	553	<10	<10	<10	<10
03/19/87	<10	118	<10	57	<10	<10
12/10/87	<25	7198	1551	128	32	290
03/01/88	<10	260	<10	133	<10	<10
06/14/88	<30	29170	2016	192	42	<30
10/06/88	<200	11244	660	250	<200	300
04/20/89	----	WELL DESTROYED				----
10/12/89	----					----

NOTE: ALL CONCENTRATIONS ARE PRESENTED IN PARTS PER BILLION (PPB)

# ANALYSIS RESULTS OF ORGANICS, CRANSTON SANITARY LANDFILL, MONITORING WELL 3-78

COMPOUND->	Methylethyl	Trichloroethylene	1,1-	1,2-	Methylisopropyl
DATE	ketone		dichloroethane	dichloroethane	Ketone
9/30/86	<10	<10	<10	<10	<10
03/19/87	<10	<10	<10	<10	<10
12/10/87	1254	<10	35	<10	<10
03/01/88	<10	<10	<10	<10	<10
06/14/88	<30	<10	<10	<10	<10
10/06/88	<200	269	163	30	<10
04/20/89	----	WELL DESTROYED			----
10/12/89	----				----

NOTE: ALL CONCENTRATIONS ARE PRESENTED IN PARTS PER BILLION (PPB)

ANALYSIS RESULTS OF ORGANICS, CRANSTON SANITARY LANDFILL, MONITORING WELL OW-4

COMPOUND- DATE	Chlorobenzene	Benzene	Toluene	Ethylbenzene	Xylene	Dioxane	Diisopropyl ether
03/19/87	1312	547	1693	<10	2710	29066	2000
12/10/87	200	173	48	41	214	15767	1150
03/01/88	283	<40	<40	<40	<40	15040	950
06/14/88	----	WELL DESTROYED					----

NOTE: ALL CONCENTRATIONS ARE PRESENTED IN PARTS PER BILLION (PPB)

ANALYSIS RESULTS OF ORGANICS, CRANSTON SANITARY LANDFILL, MONITORING WELL OW-4

COMPOUND- DATE	Isopropyl Alcohol	Tetrahydrofuran	Acetone	Dichlorobenzene	Dichloromethane	Diethyl ether
03/19/87	995	7253	6191	122	99	<10
12/10/87	<25	3710	<25	30	25	<25
03/01/88	<40	3016	64	<40	<40	<40
06/14/88	----			WELL DESTROYED		----

NOTE: ALL CONCENTRATIONS ARE PRESENTED IN PARTS PER BILLION (PPB)

ANALYSIS RESULTS OF ORGANICS, CRANSTON SANITARY LANDFILL, MONITORING WELL OW-4

COMPOUND-> DATE	Methylethyl ketone	Trichloroethylene	1,1- dichloroethane	1,2- dichloroethane	Methylisopropyl Ketone
03/19/87	4238	32	34	27	<10
12/10/87	<25	<25	<25	<25	<25
03/01/88	<40	<40	<40	<40	<40
06/14/88	----	WELL DESTROYED			----

NOTE: ALL CONCENTRATIONS ARE PRESENTED IN PARTS PER BILLION (PPB)

ANALYSIS RESULTS OF ORGANICS, CRANSTON SANITARY LANDFILL, MONITORING WELL 4-80

COMPOUND- DATE	Chlorobenzene	Benzene	Toluene	Ethylbenzene	Xylene	Dioxane	Diisopropyl ether
09/10/86	572	182	1361	<10	<10	3061	<10
03/19/87	1067	180	2518	<10	1715	43322	6500
12/10/87	1354	166	2284	491	1302	4065	3380
03/01/88	856	171	525	374	712	4064	5225
06/14/88	953	193	1650	471	1402	1650	7500
10/06/88	944	170	1909	560	1500	12832	<30
04/20/89	1315	234	2324	600	1912	4358	7800
07/25/89	1448	278	2487	1448	1993	7680	27000
10/12/89	----			WELL DESTROYED			----

NOTE: ALL CONCENTRATIONS ARE PRESENTED IN PARTS PER BILLION (PPB)

# ANALYSIS RESULTS OF ORGANICS, CRANSTON SANITARY LANDFILL, MONITORING WELL 4-80

COMPOUND- DATE	Isopropyl Alcohol	Tetrahydrofuran	Acetone	Dichlorobenzene	Dichloromethane	Diethyl ether
09/10/86	<10	5402	<10	<10	<10	<10
03/19/87	797	15753	1189	2000	11	<10
12/10/87	80	10655	<25	<25	25	210
03/01/88	<40	21104	149	<40	<40	165
06/14/88	<100	20350	<100	<100	<100	233
10/06/88	<30	19616	138	64	<30	<30
04/20/89	<600	23500	<600	<600	<600	280
07/25/89	<80	24800	<80	<80	<80	<80
10/12/89	----		WELL DESTROYED			----

NOTE: ALL CONCENTRATIONS ARE PRESENTED IN PARTS PER BILLION (PPB)

ANALYSIS RESULTS OF ORGANICS, CRANSTON SANITARY LANDFILL, MONITORING WELL 4-80

COMPOUND-> DATE	Methylethyl ketone	Trichloroethylene	1,1- dichloroethane	1,2- dichloroethane	Methylisopropyl Ketone
09/10/86	<10	<10	<10	<10	<10
03/19/87	775	<10	30	<10	<10
12/10/87	128	35	26	<25	<25
03/01/88	195	<40	<40	<40	<40
06/14/88	<100	<100	28	<100	<100
10/06/88	126	<30	31	<30	<30
04/20/89	<600	<600	<600	<600	<600
07/25/89	957	<80	<80	<80	<80
10/12/89	----	WELL DESTROYED			----

NOTE: ALL CONCENTRATIONS ARE PRESENTED IN PARTS PER BILLION (PPB)

# ANALYSIS RESULTS OF ORGANICS, CRANSTON SANITARY LANDFILL, MONITORING WELL H

COMPOUND- DATE	Chlorobenzene	Benzene	Toluene	Ethylbenzene	Xylene	Dioxane	Diisopropyl ether
07/25/89	1323	534	1628	453	696	8000	21000
10/12/89	12850	2060	14400	3235	8010	54355	9000
01/18/90	2020	405	1800	622	1530	12400	17000
04/17/90	1845	327	2916	395	1142	7809	----
07/26/90	1890	570	2000	716	1700	<2000	----
10/25/90	1380	143	2060	<100	631	<2000	----
01/31/91	1170	900	2220	270	716	4810	----
04/23/91	2580	308	2910	432	1100	7020	----
07/15/91	2070	1170	2870	1100	2400	4960	----
10/10/91	506	<100	780	296	517	<2000	----
01/24/92	1240	323	1030	530	1420	4870	----
04/23/92	787	440	<100	556	1350	4210	----
07/21/92	2400	448	1650	465	1230	3510	----
11/05/92	514	<100	<100	<100	204	<2000	----
01/26/93	660	330	340	290	750	4230	----
04/20/93							

NOTE: ALL CONCENTRATIONS ARE PRESENTED IN PARTS PER BILLION (PPB)

# ANALYSIS RESULTS OF ORGANICS, CRANSTON SANITARY LANDFILL, MONITORING WELL H

COMPOUND- DATE	Isopropyl Alcohol	Tetrahydrofuran	Acetone	Dichlorobenzene	Dichloromethane	Diethyl ether
07/25/89	<400	22000	<400	<400	<400	<400
10/12/89	<500	125360	<500	<500	<500	1290
01/18/90	<100	33000	<100	<100	<100	438
04/17/90	----	----	<1000	<300	----	----
07/26/90	----	----	<1000	<300	----	----
10/25/90	----	----	<1000	<300	----	----
01/31/91	----	----	<1000	<300	----	----
04/23/91	----	----	<1000	<300	----	----
07/15/91	----	----	<1000	<300	----	----
10/10/91	----	----	<1000	<300	----	----
01/24/92	----	----	<1000	<300	----	----
04/23/92	----	----	<1000	<300	----	----
07/21/92	----	----	<1000	<300	----	----
11/05/92	----	----	<1000	<300	----	----
01/26/93	----	----	<1000	<300	----	----
04/20/93						

NOTE: ALL CONCENTRATIONS ARE PRESENTED IN PARTS PER BILLION (PPB)

# ANALYSIS RESULTS OF ORGANICS, CRANSTON SANITARY LANDFILL, MONITORING WELL H

COMPOUND- DATE	Methylethyl ketone	Trichloroethylene	1,1- dichloroethane	1,2- dichloroethane	Methylisopropyl Ketone
07/25/89	<400	<400	<400	<400	<400
10/12/89	<500	<500	<500	<500	<500
01/18/90	<100	<100	<100	<100	<100
04/17/90	----	<100	<100	<100	----
07/26/90	----	<100	<100	<100	----
10/25/90	----	<100	<100	<100	----
01/31/91	----	<100	<100	<100	----
04/23/91	----	<100	<100	<100	----
07/15/91	----	<100	<100	<100	----
10/10/91	----	<100	<100	<100	----
01/24/92	----	<100	<100	<100	----
04/23/92	----	<100	<100	<100	----
07/21/92	----	<100	<100	<100	----
11/05/92	----	<100	<100	<100	----
01/26/93	----	<100	<100	<100	----
04/20/93					

NOTE: ALL CONCENTRATIONS ARE PRESENTED IN PARTS PER BILLION (PPB)

# BACKGROUND WELL

## ANALYSIS RESULTS OF ORGANICS, CRANSTON SANITARY LANDFILL, MONITORING WELL Z

COMPOUND- DATE	Chlorobenzene	Benzene	Toluene	Ethylbenzene	Xylene	Dioxane	Diisopropyl ether
09/10/86	<10	<10	<10	<10	<10	<10	<10
03/19/87	<10	<10	<10	<10	<10	<10	<10
12/29/87	<25	<25	<25	<25	<25	<25	<25
03/01/88	<40	<40	<40	<40	<40	<40	<40
06/14/88	<10	<10	<10	<10	<10	<10	<10
10/06/88	1.6	<10	<10	<10	2.4	<10	<10
01/09/89	<10	<10	<10	<10	<10	<10	<10
04/20/89	<10	<10	<10	<10	<10	<10	<10
07/25/89	<10	<10	<10	<10	<10	<10	<10
10/12/89	<10	<10	<10	<10	<10	<10	<10
01/18/90	<10	<10	<10	<10	<10	<10	<10
04/17/90	<1	<1	<1	<1	<1	<20	----
07/26/90	<1	<1	<1	<1	<1	<20	----
10/25/90	<1	<1	<1	<1	<1	<20	----
01/31/91	<1	<1	<1	<1	<1	<20	----
04/23/91	1.4	<1	<1	<1	<1	<20	----
07/15/91	<1	<1	<1	<1	<1	<20	----
10/10/91	<1	<1	<1	<1	<1	<20	----
01/24/92	<1	<1	<1	<1	<1	<20	----
04/23/92	1.2	<1	<1	<1	<1	<20	----
07/21/92	<1	<1	<1	<1	<1	<20	----
11/05/92	<1	<1	<1	<1	<1	<20	----
01/26/93	2.4	<1	<1	<1	<1	<20	----
04/20/93							

NOTE: ALL CONCENTRATIONS ARE PRESENTED IN PARTS PER BILLION (PPB)

# BACKGROUND WELL

## ANALYSIS RESULTS OF ORGANICS, CRANSTON SANITARY LANDFILL, MONITORING WELL Z

COMPOUND- DATE	Isopropyl Alcohol	Tetrahydrofuran	Acetone	Dichlorobenzene	Dichloromethane	Diethyl ether
09/10/86	<10	<10	<10	<10	<10	<10
03/19/87	<10	<10	<10	<10	<10	<10
12/29/87	<25	<25	<25	<25	<25	<25
03/01/88	<40	<40	<40	<40	<40	<40
06/14/88	<10	<10	<10	<10	<10	<10
10/06/88	<10	<10	<10	<10	<10	<10
01/09/89	<10	<10	<10	<10	<10	<10
04/20/89	<10	<10	<10	<10	<10	<10
07/25/89	<10	<10	<10	<10	<10	<10
10/12/89	<10	<10	<10	<10	<10	<10
01/18/90	<10	<10	<10	<10	<10	<10
04/17/90	----	----	<10	<3	----	----
07/26/90	----	----	<10	<3	----	----
10/25/90	----	----	<10	<3	----	----
01/31/91	----	----	<10	<3	----	----
04/23/91	----	----	<10	<3	----	----
07/15/91	----	----	<10	<3	----	----
10/10/91	----	----	<10	<3	----	----
01/24/92	----	----	<10	<3	----	----
04/23/92	----	----	<10	<3	----	----
07/21/92	----	----	<10	<3	----	----
11/05/92	----	----	<10	<3	----	----
01/26/93	----	----	<10	<3	----	----
04/20/93						

NOTE: ALL CONCENTRATIONS ARE PRESENTED IN PARTS PER BILLION (PPB)

# BACKGROUND WELL

## ANALYSIS RESULTS OF ORGANICS, CRANSTON SANITARY LANDFILL, MONITORING WELL Z

COMPOUND-> DATE	Methylethyl ketone	Trichloroethylene	1,1- dichloroethane	1,2- dichloroethane	Methylisopropyl Ketone
09/10/86	<10	<10	<10	<10	<10
03/19/87	<10	<10	<10	<10	<10
12/29/87	<25	<25	<25	<25	<25
03/01/88	<40	<40	<40	<40	<40
06/14/88	<10	<10	<10	<10	<10
10/06/88	<10	<10	<10	<10	<10
01/09/89	<10	<10	<10	<10	<10
04/20/89	<10	<10	<10	<10	<10
07/25/89	<10	<10	<10	<10	<10
10/12/89	<10	<10	<10	<10	<10
01/18/90	<10	<10	<10	<10	<10
04/17/90	----	<1	<1	<1	----
07/26/90	----	<1	<1	<1	----
10/25/90	----	<1	<1	<1	----
01/31/91	----	<1	<1	<1	----
04/23/91	----	<1	<1	<1	----
07/15/91	----	<1	<1	<1	----
10/10/91	----	<1	<1	<1	----
01/24/92	----	<1	<1	<1	----
04/23/92	----	<1	<1	<1	----
07/21/92	----	<1	<1	<1	----
11/05/92	----	<1	<1	<1	----
01/26/93	----	<1	<1	<1	----
04/20/93					

NOTE: ALL CONCENTRATIONS ARE PRESENTED IN PARTS PER BILLION (PPB)

**APPENDIX 3**  
**INORGANIC AND ORGANIC**  
**LEACHATE COLLECTION TANKS SAMPLING RESULTS**  
**1986-1988**

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# ANALYSIS RESULTS OF ORGANICS, CRANSTON SANITARY LANDFILL, LEACHATE COLLECTION TANKS

COMPOUND- DATE	Isopropyl Alcohol	Tetrahydrofuran	Acetone	Dichlorobenzene	Dichloromethane	Diethyl ether
09/10/86	<10	5343	<10	<10	<10	<10
03/19/87	600	5273	615	21	29	<10
12/29/87	120	7626	<25	27	<25	250
03/01/88	<40	768	46	<40	<40	175
06/14/88	<10	8455	740	<10	<10	95
10/06/88	----	RECORDS FOR SAMPLING OF THE LEACHATE COLLECTION TANKS AFTER THIS DATE WERE NOT FOUND				----
	----					----

NOTE: ALL CONCENTRATIONS ARE PRESENTED IN PARTS PER BILLION (PPB)

**APPENDIX 4**  
**SEDIMENT SAMPLING RESULTS**  
**DECEMBER 1993**

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In Response To The Future

## CERTIFICATE OF ANALYSIS

Client: RIDEM

Client Project ID: 12/14 Sampling

Client Sample ID: SD-2

Date Sample Received: 12/14/93

ESS Project ID: 934148

ESS Sample ID: 934148-02

Date Reported: 1/19/94

Parameter	Result	Units	MRL	Method
Percent Solids	80	% w/w	1	160.3
<b>Total Metals</b>				
Arsenic	2	mg/Kg	1	7060
Barium	79	mg/Kg	20	6010
Cadmium	ND	mg/Kg	1	6010
Chromium	6	mg/Kg	5	6010
Lead	92	mg/Kg	10	6010
Mercury	ND	mg/Kg	0.5	7471
Selenium	ND	mg/Kg	1	7740
Silver	ND	mg/Kg	1	6010
Polychlorinated Biphenyls	ND	mg/Kg	Attached	8081
<b>Semivolatile Organics</b>				
Fluoranthene	406	ug/Kg	Attached	8270
Bis(2-ethylhexyl)phthalate	210,000	ug/Kg	Attached	8270
Di-n-octylphthalate	2,570	ug/Kg	Attached	8270
Phenanthrene	470	ug/Kg	Attached	8270
Pyrene	1,260	ug/Kg	Attached	8270
<b>Volatile Organics</b>				
Acetone	252	ug/Kg	Attached	8260

ND = Not Detected above Method Reporting Limit (MRL)

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Approved by: 

Date: 2/19/94

Environmental Science Services

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0006





In Response To The Future

## CERTIFICATE OF ANALYSIS

Client: RIDEM

Client Project ID: 12/14 Sampling

Client Sample ID: SD-3

Date Sample Received: 12/14/93

ESS Project ID: 934148

ESS Sample ID: 934148-03

Date Reported: 1/19/94

Parameter	Result	Units	MRL	Method
Percent Solids	84	% w/w	1	160.3
Total Metals				
Arsenic	2	mg/Kg	1	7060
Barium	36	mg/Kg	20	6010
Cadmium	1	mg/Kg	1	6010
Chromium	ND	mg/Kg	5	6010
Lead	36	mg/Kg	10	6010
Mercury	ND	mg/Kg	0.5	7471
Selenium	ND	mg/Kg	1	7740
Silver	ND	mg/Kg	1	6010
Polychlorinated Biphenyls	ND	mg/Kg	Attached	8081
Semivolatile Organics				
Bis(2-ethylhexyl)phthalate	303,000	ug/Kg	Attached	8270
Di-n-octylphthalate	8,640	ug/Kg	Attached	8270
Pyrene	687	ug/Kg	Attached	8270
Volatile Organics				
Acetone	196	ug/Kg	Attached	8260

ND =, Not Detected above Method Reporting Limit (MRL)

109

Approved by: 

Date: 2/2/94

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0011





In Response To The Future

## CERTIFICATE OF ANALYSIS

Client: RIDEM

Client Project ID: 12/14 Sampling

Client Sample ID: SD-4

Date Sample Received: 12/14/93

ESS Project ID: 934148

ESS Sample ID: 934148-04

Date Reported: 1/19/94

Parameter	Result	Units	MRL	Method
<b>Percent Solids</b>	74	% w/w	1	160.3
<b>Total Metals</b>				
Arsenic	3	mg/Kg	1	7060
Barium	58	mg/Kg	20	6010
Cadmium	2	mg/Kg	1	6010
Chromium	ND	mg/Kg	5	6010
Lead	51	mg/Kg	10	6010
Mercury	ND	mg/Kg	0.5	7471
Selenium	ND	mg/Kg	1	7740
Silver	ND	mg/Kg	1	6010
<b>Polychlorinated Biphenyls</b>	ND	mg/Kg	Attached	8081
<b>Semivolatile Organics</b>				
Fluoranthene	625	ug/Kg	Attached	8270
Bis(2-ethylhexyl)phthalate	17,100	ug/Kg	Attached	8270
Di-n-octylphthalate	495	ug/Kg	Attached	8270
Benzo(a)anthracene	356	ug/Kg	Attached	8270
Chrysene	481	ug/Kg	Attached	8270
Phenanthrene	459	ug/Kg	Attached	8270
Pyrene	2,830	ug/Kg	Attached	8270
<b>Volatile Organics</b>				
Acetone	208	ug/Kg	Attached	8260

ND = Not Detected above Method Reporting Limit (MRL)

110

Approved by: 

Date: 

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0016





# CERTIFICATE OF ANALYSIS

Date Reported: 1/19/94

ND = Not Detected above Method Reporting Limit (MRL)



In Response To The Future

## CERTIFICATE OF ANALYSIS

Client: RIDEM

Client Project ID: 12/14 Sampling

ESS Project ID: 934148

Client Sample ID: SD-6

ESS Sample ID: 934148-06

Date Sample Received: 12/14/93

Date Reported: 1/19/94

Parameter	Result	Units	MRL	Method
Percent Solids	50	% w/w	1	160.3
Total Metals				
Arsenic	3	mg/Kg	1	7060
Barium	76	mg/Kg	20	6010
Cadmium	1	mg/Kg	1	6010
Chromium	ND	mg/Kg	5	6010
Lead	44	mg/Kg	10	6010
Mercury	ND	mg/Kg	0.5	7471
Selenium	ND	mg/Kg	1	7740
Silver	ND	mg/Kg	1	6010
Polychlorinated Biphenyls				
Arochlor 1248	7	mg/Kg	Attached	8081
Arochlor 1254	5	mg/Kg	Attached	8081
Semivolatile Organics	ND	ug/Kg	Attached	8270
Volatile Organics				
Acetone	591	ug/Kg	Attached	8260
Methylene Chloride	8	ug/Kg	Attached	8260
Methyl Ethyl Ketone	85	ug/Kg	Attached	8260
Toluene	9	ug/Kg	Attached	8260
Chlorobenzene	309	ug/Kg	Attached	8260
Xylenes (Total)	903	ug/Kg	Attached	8260
Dichlorobenzene (Total)	219	ug/Kg	Attached	8260

ND = Not Detected above Method Reporting Limit (MRL)

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Approved by: 

Date: 20 Jan 94

Environmental Science Services

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0026





In Response To The Future

## CERTIFICATE OF ANALYSIS

Client: RIDEM

Client Project ID: 12/14 Sampling

Client Sample ID: SD-7

Date Sample Received: 12/14/93

ESS Project ID: 934148

ESS Sample ID: 934148-07

Date Reported: 1/19/94

Parameter	Result	Units	MRL	Method
<b>Percent Solids</b>	69	% w/w	1	160.3
<b>Total Metals</b>				
Arsenic	2	mg/Kg	1	7060
Barium	62	mg/Kg	20	6010
Cadmium	1	mg/Kg	1	6010
Chromium	ND	mg/Kg	5	6010
Lead	31	mg/Kg	10	6010
Mercury	ND	mg/Kg	0.5	7471
Selenium	ND	mg/Kg	1	7740
Silver	ND	mg/Kg	1	6010
<b>Polychlorinated Biphenyls</b>	ND	mg/Kg	Attached	8081
<b>Semivolatile Organics</b>				
Di-n-octylphthalate	434	ug/Kg	Attached	8270
<b>Volatile Organics</b>				
Acetone	208	ug/Kg	Attached	8260
Chlorobenzene	29	ug/Kg	Attached	8260

ND = Not Detected above Method Reporting Limit (MRL)

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Approved by: 

Date: 2/29/94

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0031





In Response To The Future

## CERTIFICATE OF ANALYSIS

Client: RIDEM

Client Project ID: 12/14 Sampling

Client Sample ID: SD-8

Date Sample Received: 12/14/93

ESS Project ID: 934148

ESS Sample ID: 934148-08

Date Reported: 1/19/94

Parameter	Result	Units	MRL	Method
<b>Percent Solids</b>	82	% w/w	1	160.3
<b>Total Metals</b>				
Arsenic	2	mg/Kg	1	7060
Barium	39	mg/Kg	20	6010
Cadmium	1	mg/Kg	1	6010
Chromium	ND	mg/Kg	5	6010
Lead	20	mg/Kg	10	6010
Mercury	ND	mg/Kg	0.5	7471
Selenium	ND	mg/Kg	1	7740
Silver	ND	mg/Kg	1	6010
<b>Polychlorinated Biphenyls</b>	ND	mg/Kg	Attached	8081
<b>Semivolatile Organics</b>				
Fluoranthene	533	ug/Kg	Attached	8270
Phenanthrene	343	ug/Kg	Attached	8270
Pyrene	1,740	ug/Kg	Attached	8270
<b>Volatile Organics</b>				
Acetone	235	ug/Kg	Attached	8260
Methylene Chloride	10	ug/Kg	Attached	8260
Chlorobenzene	23	ug/Kg	Attached	8260

ND = Not Detected above Method Reporting Limit (MRL)

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Approved by: 

Date: 2/19/94

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0036



## CERTIFICATE OF ANALYSIS

Client: RIDEM

Client Project ID: 12/15 Sampling

ESS Project ID: 934170

Client Sample ID: SD-9

ESS Sample ID: 934170-01

Date Sample Received: 12/15/93

Date Reported: 1/19/94

Parameter	Result	Units	MRL	Method
Percent Solids	71	% w/w	1	160.3
Total Metals				
Arsenic	3	mg/Kg	1	7060
Barium	57	mg/Kg	20	6010
Cadmium	1	mg/Kg	1	6010
Chromium	22	mg/Kg	5	6010
Lead	21	mg/Kg	10	6010
Mercury	ND	mg/Kg	0.5	7471
Selenium	ND	mg/Kg	1	7740
Silver	ND	mg/Kg	1	6010
Polychlorinated Biphenyls	ND	mg/Kg	Attached	8081
Semivolatile Organics	ND	ug/Kg	Attached	8270
Volatile Organics				
Chlorobenzene	18	ug/Kg	Attached	8260

ND = Not Detected above Method Reporting Limit (MRL)

Approved by: 

Date: 2/29/94

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0001

## CERTIFICATE OF ANALYSIS

Client: RIDEM

Client Project ID: 12/15 Sampling

ESS Project ID: 934170

Client Sample ID: SD-10

ESS Sample ID: 934170-02

Date Sample Received: 12/15/93

Date Reported: 1/19/94

Parameter	Result	Units	MRL	Method
Percent Solids	62	% w/w	1	160.3
Total Metals				
Arsenic	8	mg/Kg	1	7060
Barium	160	mg/Kg	20	6010
Cadmium	1	mg/Kg	1	6010
Chromium	17	mg/Kg	5	6010
Lead	25	mg/Kg	10	6010
Mercury	ND	mg/Kg	0.5	7471
Selenium	ND	mg/Kg	1	7740
Silver	ND	mg/Kg	1	6010
Polychlorinated Biphenyls	ND	mg/Kg	Attached	8081
Semivolatile Organics	ND	ug/Kg	Attached	8270
Volatile Organics				
Acetone	144	ug/Kg	Attached	8260
Chlorobenzene	70	ug/Kg	Attached	8260

ND = Not Detected above Method Reporting Limit (MRL)

Approved by: Date: 20 Jan 94

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0006

# CERTIFICATE OF ANALYSIS

Client: RIDEM

Client Project ID: 12/15 Sampling

Client Sample ID: SD-11

Date Sample Received: 12/15/93

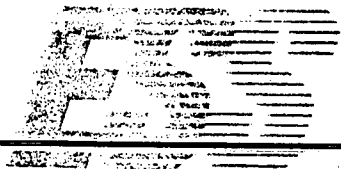
ESS Project ID: 934170

ESS Sample ID: 934170-03

Date Reported: 1/19/94

Parameter	Result	Units	MRL	Method
<b>Percent Solids</b>	86	% w/w	1	160.3
<b>Total Metals</b>				
Arsenic	1	mg/Kg	1	7060
Barium	43	mg/Kg	20	6010
Cadmium	ND	mg/Kg	1	6010
Chromium	ND	mg/Kg	5	6010
Lead	ND	mg/Kg	10	6010
Mercury	ND	mg/Kg	0.5	7471
Selenium	ND	mg/Kg	1	7740
Silver	ND	mg/Kg	1	6010
<b>Polychlorinated Biphenyls</b>	ND	mg/Kg	Attached	8081
<b>Semivolatile Organics</b>	ND	ug/Kg	Attached	8270
<b>Volatile Organics</b>				
Acetone	74	ug/Kg	Attached	8260

ND = Not Detected above Method Reporting Limit (MRL)



In Response To The Future

## CERTIFICATE OF ANALYSIS

Client: RIDEM

Client Project ID: 12/15 Sampling

Client Sample ID: SD-12

Date Sample Received: 12/15/93

ESS Project ID: 934170

ESS Sample ID: 934170-04

Date Reported: 1/19/94

Parameter	Result	Units	MRL	Method
Percent Solids	86	% w/w	1	160.3
Total Metals				
Arsenic	3	mg/Kg	1	7060
Barium	58	mg/Kg	20	6010
Cadmium	ND	mg/Kg	1	6010
Chromium	6	mg/Kg	5	6010
Lead	ND	mg/Kg	10	6010
Mercury	ND	mg/Kg	0.5	7471
Selenium	ND	mg/Kg	1	7740
Silver	ND	mg/Kg	1	6010
Polychlorinated Biphenyls	ND	mg/Kg	Attached	8081
Semivolatile Organics	ND	ug/Kg	Attached	8270
Volatile Organics				
Acetone	63	ug/Kg	Attached	8260

ND = Not Detected above Method Reporting Limit (MRL)

118

Approved by: 

Date: 20 Jan 94

Environmental Science Services

532 Atwells Avenue, Providence, Rhode Island 02909 (401) 421-0398 Fax: (401) 421-5731

0016

# CERTIFICATE OF ANALYSIS

Client: RIDEM

Client Project ID: 12/15 Sampling

ESS Project ID: 934170

Client Sample ID: SD-13

ESS Sample ID: 934170-05

Date Sample Received: 12/15/93

Date Reported: 1/19/94

Parameter	Result	Units	MRL	Method
Percent Solids	66	% w/w	1	160.3
<b>Total Metals</b>				
Arsenic	ND	mg/Kg	1	7060
Barium	65	mg/Kg	20	6010
Cadmium	ND	mg/Kg	1	6010
Chromium	ND	mg/Kg	5	6010
Lead	24	mg/Kg	10	6010
Mercury	ND	mg/Kg	0.5	7471
Selenium	ND	mg/Kg	1	7740
Silver	ND	mg/Kg	1	6010
Polychlorinated Biphenyls	ND	mg/Kg	Attached	8081
<b>Semivolatile Organics</b>				
Di-n-octylphthalate	1,990	ug/Kg	Attached	8270
<b>Volatile Organics</b>				
Acetone	54	ug/Kg	Attached	8260
Methylene Chloride	12	ug/Kg	Attached	8260
Trichloroethene	5	ug/Kg	Attached	8260
Toluene	6	ug/Kg	Attached	8260
Chlorobenzene	19	ug/Kg	Attached	8260

ND = Not Detected above Method Reporting Limit (MRL)

Approved by: Date: 2/19/94

0021

## CERTIFICATE OF ANALYSIS

Client: RIDEM

Client Project ID: 12/15 Sampling

ESS Project ID: 934170

Client Sample ID: SD-14

ESS Sample ID: 934170-06

Date Sample Received: 12/15/93

Date Reported: 1/19/94

Parameter	Result	Units	MRL	Method
Percent Solids	85	% w/w	1	160.3
Total Metals				
Arsenic	3	mg/Kg	1	7060
Barium	62	mg/Kg	20	6010
Cadmium	ND	mg/Kg	1	6010
Chromium	ND	mg/Kg	5	6010
Lead	ND	mg/Kg	10	6010
Mercury	ND	mg/Kg	0.5	7471
Selenium	ND	mg/Kg	1	7740
Silver	ND	mg/Kg	1	6010
Polychlorinated Biphenyls	ND	mg/Kg	Attached	8081
Semivolatile Organics				
Pyrene	436	ug/Kg	Attached	8270
Volatile Organics				
Acetone	64	ug/Kg	Attached	8260

ND = Not Detected above Method Reporting Limit (MRL)

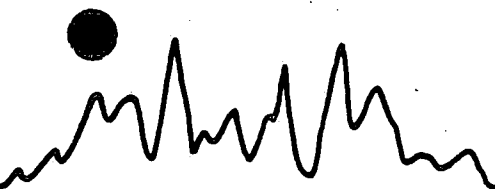
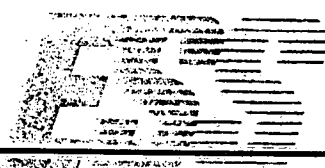
120

Approved by: Date: 2/2/94

Environmental Science Services

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0026



In Response To The Future

# CERTIFICATE OF ANALYSIS

Client: RIDEM

Client Project ID: 12/15 Sampling

ESS Project ID: 934170

Client Sample ID: SD-15

ESS Sample ID: 934170-07

Date Sample Received: 12/15/93

Date Reported: 1/19/94

Parameter	Result	Units	MRL	Method
Percent Solids	83	% w/w	1	160.3
Total Metals				
Arsenic	1	mg/Kg	1	7060
Barium	44	mg/Kg	20	6010
Cadmium	ND	mg/Kg	1	6010
Chromium	ND	mg/Kg	5	6010
Lead	ND	mg/Kg	10	6010
Mercury	ND	mg/Kg	0.5	7471
Selenium	ND	mg/Kg	1	7740
Silver	ND	mg/Kg	1	6010
Polychlorinated Biphenyls	ND	mg/Kg	Attached	8081
Semivolatile Organics				
Fluoranthene	350	ug/Kg	Attached	8270
Bis(2-ethylhexyl)phthalate	590	ug/Kg	Attached	8270
Di-n-octylphthalate	1,670	ug/Kg	Attached	8270
Pyrene	787	ug/Kg	Attached	8270
Volatile Organics				
Acetone	78	ug/Kg	Attached	8260
Methylene Chloride	7	ug/Kg	Attached	8260

ND = Not Detected above Method Reporting Limit (MRL)

Approved by:   
Environmental Science Services

Date: 20 Jan 94





A Response To The Future

## CERTIFICATE OF ANALYSIS

Client: RIDEM

Client Project ID: 12/16 Sampling

ESS Project ID: 934191

Client Sample ID: SD-16

ESS Sample ID: 934191-01

Date Sample Received: 12/16/93

Date Reported: 1/28/94

Parameter	Result	Units	MRL	Method
Percent Solids	82	% w/w	1	160.3
Total Metals				
Arsenic	2	mg/Kg	1	7060
Barium	84	mg/Kg	20	6010
Cadmium	3	mg/Kg	1	6010
Chromium	93	mg/Kg	5	6010
Lead	286	mg/Kg	10	6010
Mercury	0.8	mg/Kg	0.5	7471
Selenium	ND	mg/Kg	1	7740
Silver	ND	mg/Kg	1	6010
Polychlorinated Biphenyls	ND	mg/Kg	Attached	8081
Semivolatile Organics				
Fluoranthene	514	ug/Kg	Attached	8270
Bis(2-ethylhexyl)phthalate	531	ug/Kg	Attached	8270
Chrysene	344	ug/Kg	Attached	8270
Pyrene	459	ug/Kg	Attached	8270
Volatile Organics				
Acetone	60	ug/Kg	Attached	8260

ND = Not Detected above Method Reporting Limit (MRL)

122

Approved by: [Signature]

Date: 2/4/94

Environmental Science Services

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## CERTIFICATE OF ANALYSIS

Client: RIDEM

Client Project ID: 12/16 Sampling

ESS Project ID: 934191

Client Sample ID: SD-17

ESS Sample ID: 934191-02

Date Sample Received: 12/16/93

Date Reported: 1/28/94

Parameter	Result	Units	MRL	Method
Percent Solids	51	% w/w	1	160.3
Total Metals				
Arsenic	14	mg/Kg	1	7060
Barium	70	mg/Kg	20	6010
Cadmium	2	mg/Kg	1	6010
Chromium	102	mg/Kg	5	6010
Lead	345	mg/Kg	10	6010
Mercury	2.5	mg/Kg	0.5	7471
Selenium	ND	mg/Kg	1	7740
Silver	ND	mg/Kg	1	6010
Polychlorinated Biphenyls	ND	mg/Kg	Attached	8081
Semivolatile Organics				
Fluoranthene	1,850	ug/Kg	Attached	8270
Naphthalene	1,880	ug/Kg	Attached	8270
Benzo(a)anthracene	1,090	ug/Kg	Attached	8270
Benzo(a)pyrene	522	ug/Kg	Attached	8270
Benzo(b)fluoranthene	658	ug/Kg	Attached	8270
Benzo(k)fluoranthene	660	ug/Kg	Attached	8270
Chrysene	668	ug/Kg	Attached	8270
Fluorene	347	ug/Kg	Attached	8270
Phenanthrene	708	ug/Kg	Attached	8270
Pyrene	760	ug/Kg	Attached	8270
Volatile Organics				
Acetone	127	ug/Kg	Attached	8260

ND = Not Detected above Method Reporting Limit (MRL)

123

Approved by: *[Signature]*

Date: 2/4/94

Environmental Science Services

532 Atwells Avenue, Providence, Rhode Island 02909 (401) 421-0398 Fax: (401) 421-5731



In Response To The Order

## CERTIFICATE OF ANALYSIS

Client: RIDEM

Client Project ID: 12/16 Sampling

ESS Project ID: 934191

Client Sample ID: SD-18

ESS Sample ID: 934191-03

Date Sample Received: 12/16/93

Date Reported: 1/28/94

Parameter	Result	Units	MRL	Method
Percent Solids	57	% w/w	1	160.3
Total Metals				
Arsenic	5	mg/Kg	1	7060
Barium	127	mg/Kg	20	6010
Cadmium	19	mg/Kg	1	6010
Chromium	840	mg/Kg	5	6010
Lead	226	mg/Kg	10	6010
Mercury	0.6	mg/Kg	0.5	7471
Selenium	ND	mg/Kg	1	7740
Silver	ND	mg/Kg	1	6010
Polychlorinated Biphenyls	ND	mg/Kg	Attached	8081
Semivolatile Organics	ND	ug/Kg	Attached	8270
Volatile Organics				
Acetone	72	ug/Kg	Attached	8260
Chlorobenzene	69	ug/Kg	Attached	8260

ND = Not Detected above Method Reporting Limit (MRL)

124

Approved by: B. Hall

Date: 2/4/94

Environmental Science Services

532 Atwells Avenue, Providence, Rhode Island 02909 (401) 421-0330

(401) 421-5731



In Response To The Future

# CERTIFICATE OF ANALYSIS

## VOLATILE ORGANICS Method 8260

Client: RIDEM

Client Project ID: 12/15 Sampling

Client Sample ID: B1

Date Sampled: 12/15/93

Date Analyzed: 12/28/93

ESS Project ID: 934170

ESS Sample ID: 934170-08

Dilution Factor: 1x

Units: ug/L

Parameter	Result	MRL
Chloromethane	ND	10
Vinyl Chloride	ND	10
Bromomethane	ND	10
Chloroethane	ND	10
Trichlorofluoromethane	ND	5
1,1-Dichloroethene	ND	5
Acetone	ND	50
Carbon Disulfide	ND	5
Methylene Chloride	ND	5
Methyl tert-Butyl Ether	ND	10
Trans-1,2-Dichloroethene	ND	5
1,1-Dichloroethane	ND	5
Cis-1,2-Dichloroethene	ND	5
Methyl Ethyl Ketone	ND	50
Chloroform	ND	5
1,1,1-Trichloroethane	ND	5
Carbon Tetrachloride	ND	5
Benzene	ND	5
1,2-Dichloroethane	ND	5
Trichloroethene	ND	5
1,2-Dichloropropane	ND	5
Bromodichloromethane	ND	5
Cis-1,3-Dichloropropene	ND	5
Methyl Isobutyl Ketone	ND	50
Toluene	ND	5
Trans-1,3-Dichloropropene	ND	5
1,1,2-Trichloroethane	ND	5
Tetrachloroethene	ND	5
2-Hexanone	ND	50
Dibromochloromethane	ND	5
Chlorobenzene	ND	5
Ethylbenzene	ND	5
Xylenes (Total)	ND	10
Styrene	ND	5
Bromoform	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Dichlorobenzene (Total)	ND	10

ND = Not Detected above Method Reporting Limit (MRL)

Approved by: 

125

Date: 

0036





In Response To The Future

# CERTIFICATE OF ANALYSIS

## VOLATILE ORGANICS Method 8260

Client: RIDEM

Client Project ID: 12/15 Sampling

Client Sample ID: B2

Date Sampled: 12/15/93

Date Analyzed: 12/28/93

ESS Project ID: 934170

ESS Sample ID: 934170-09

Dilution Factor: 1x

Units: ug/L

Parameter	Result	MRL
Chloromethane	ND	10
Vinyl Chloride	ND	10
Bromomethane	ND	10
Chloroethane	ND	10
Trichlorofluoromethane	ND	5
1,1-Dichloroethene	ND	5
Acetone	ND	50
Carbon Disulfide	ND	5
Methylene Chloride	5	5
Methyl tert-Butyl Ether	ND	10
Trans-1,2-Dichloroethene	ND	5
1,1-Dichloroethane	ND	5
Cis-1,2-Dichloroethene	ND	5
Methyl Ethyl Ketone	ND	50
Chloroform	ND	5
1,1,1-Trichloroethane	ND	5
Carbon Tetrachloride	ND	5
Benzene	ND	5
1,2-Dichloroethane	ND	5
Trichloroethene	ND	5
1,2-Dichloropropane	ND	5
Bromodichloromethane	ND	5
Cis-1,3-Dichloropropene	ND	5
Methyl Isobutyl Ketone	ND	50
Toluene	ND	5
Trans-1,3-Dichloropropene	ND	5
1,1,2-Trichloroethane	ND	5
Tetrachloroethene	ND	5
2-Hexanone	ND	50
Dibromochloromethane	ND	5
Chlorobenzene	ND	5
Ethylbenzene	ND	5
Xylenes (Total)	ND	10
Styrene	ND	5
Bromoform	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Dichlorobenzene (Total)	ND	10

ND = Not Detected above Method Reporting Limit (MRL)

Approved by: 

Environmental Science Services

126

Date: 2/2/94



SD-1 through SD-8

**QUALITY CONTROL SECTION**

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In Response To The Future

## CERTIFICATE OF ANALYSIS

### PCB SURROGATE RECOVERY

Client: RIDEM

Client  
Project ID: 12/14 Sampling

Date Sample Analyzed: 12/16/93

ESS  
Project ID: 934148

SAMPLE ID	2,4,5,6 TETRACHLORO-M- XYLENE (50-150%) *	DECACHLOROBIPHENYL (50-150%) *
P1215B1	98%	106%
934148-01	111	114
934148-02	99	103
934148-03	101	106
934148-04	53	56
934148-05	98	109
934148-06	97	112
934148-07	94	109
934148-08	96	103

\* Advisory Limits

128

Approved by: 

Environmental Science Services

Date: 

0044



In Response To The Future

# CERTIFICATE OF ANALYSIS

## POLYCHLORINATED BIPHENYLS Method 8081

Client: RIDEM

Client Project ID: 12/14 Sampling

ESS Project ID: 934148

Client Sample ID: Method Blank

ESS Sample ID: P1215B1

Date Sample Received: N/A


Date Reported: 1/19/94

Parameter	Result (mg/Kg)	MRL
Arochlor 1016	ND	1
Arochlor 1221	ND	1
Arochlor 1232	ND	1
Arochlor 1242	ND	1
Arochlor 1248	ND	1
Arochlor 1254	ND	1
Arochlor 1260	ND	1

N/A = Not Applicable

ND = Not Detected above Method Reporting Limit (MRL)

129

Approved by:   
Environmental Science Services

Date: 20 Jan 94

0045



In Response To The Future

## CERTIFICATE OF ANALYSIS

### ACID SURROGATE RECOVERY

Client: RIDEM

Client  
Project ID: 12/14 Sampling

Date Sample Analyzed: 1/17/94

ESS  
Project ID: 934148

SAMPLE ID	(2CP) (33-110) *	(PHL) (10-110%) *	(2FP) (21-110%) *	(TBP) (10-123%) *
S1220B1	71%	28%	22%	274%#
934148-01	101	86	89	76
934148-02	100	84	89	81
934148-03	89	80	75	48
934148-04	88	70	81	77
934148-05	34	28	34	37
934148-06	44	34	40	50
934148-07	45	36	44	49
934148-08	46	36	45	41

#### \* QC Limits

# Surrogate Recovery is outside Acceptance criteria, three of four compounds must be within criteria.

2CP = 2-CHLOROPHENOL-D4

PHL = PHENOL-D5

2FP = 2-FLUOROPHENOL

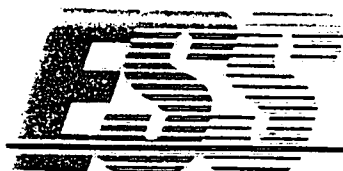
TBP = 2,4,6 TRIBROMOPHENOL

130

Approved by:   
Environmental Science Services

Date: 20 Jan 94

0046



In Response To The Future

## CERTIFICATE OF ANALYSIS

### BASE-NEUTRAL SURROGATE RECOVERY

Client: RIDEM

Client  
Project ID: 12/14 Sampling

Date Sample Analyzed: 1/17/94

ESS  
Project ID: 934148

SAMPLE ID	(DCB) (16-110) *	(NBZ) (35-114%) *	(FBP) (43-116%) *	(TPH) (33-141%) *
S1220B1	91%	81%	83%	64%
934148-01	105	112	115	130
934148-02	104	114	119#	146#
934148-03	107	114	105	117
934148-04	102	126#	125#	403#
934148-05	39	47	46	52
934148-06	50	57	59	87
934148-07	51	59	61	112
934148-08	54	58	60	142#

#### \* QC Limits

# Surrogate Recovery is outside Acceptance criteria, three of four compounds must be within criteria.

DCB = 1,2-DICHLOROBENZENE-D4

NBZ = NITROBENZENE-D5

FBP = 2-FLUOROBIPHENYL

TPH = P-TERPHENYL-D14

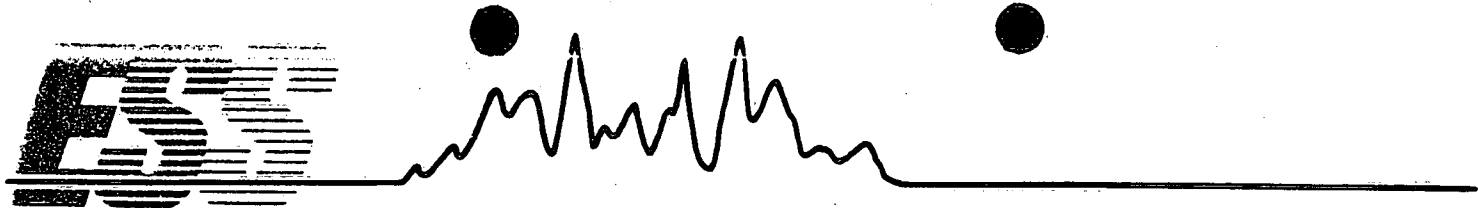
131

Approved by: 

Date: 20 Jan 94

Environmental Science Services

0047



In Response To The Future

## CERTIFICATE OF ANALYSIS

BASE-NEUTRAL & ACID EXTRACTABLES

EPA 8270 (Page 1 of 2)

Client: RIDEM

Client Project ID: 12/14 Sampling

ESS Project ID: 934148

Client Sample ID: Method Blank

ESS Sample ID: S1220B1

Date Sampled: N/A

Date Extracted: 12/20/93

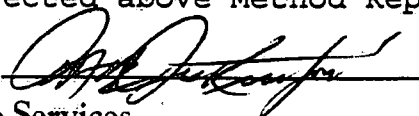
Date Analyzed: 1/17/94

Dilution Factor: 1x

Parameter	Result (ug/Kg)	MRL
2-Chlorophenol	ND	330
2-Nitrophenol	ND	330
Phenol	ND	330
2,4-Dimethylphenol	ND	330
2,4-Dichlorophenol	ND	330
2,4-Dinitrophenol	ND	1,650
Pentachlorophenol	ND	1,650
4-Nitrophenol	ND	1,650
2,4,6-Trichlorophenol	ND	330
2,4,5-Trichlorophenol	ND	1,650
2-Methylphenol	ND	330
4-Methylphenol	ND	330
4-Chloro-3-Methylphenol	ND	330
4,6-Dinitro-2-Methylphenol	ND	1,650
Acenaphthylene	ND	330
1,2,4-Trichlorobenzene	ND	330
Hexachlorobenzene	ND	330
Bis(2-chloroethyl) ether	ND	330
2-Chloronaphthalene	ND	330
1,2-Dichlorobenzene	ND	330
1,3-Dichlorobenzene	ND	330
1,4-Dichlorobenzene	ND	330
3,3-Dichlorobenzidine	ND	660
2,4-Dinitrotoluene	ND	330
2,6-Dinitrotoluene	ND	330
Fluoranthene	ND	330
4-Chlorophenyl phenyl ether	ND	330
Bis(2-chloroisopropyl) ether	ND	330
Bis(2-chloroethoxy) methane	ND	330
Hexachlorobutadiene	ND	330
Hexachlorocyclopentadiene	ND	330
Isophorone	ND	330
Naphthalene	ND	330

N/A = Not Applicable

ND = Not Detected above Method Reporting Limit (MRL)

Approved by: 

132

Date: 

Environmental Science Services

6043



In Response To The Future

# CERTIFICATE OF ANALYSIS

BASE-NEUTRAL & ACID EXTRACTABLES

EPA 8270 (Page 2 of 2)

Client: RIDEM

Client Project ID: 12/14 Sampling

ESS Project ID: 934148

Client Sample ID: Method Blank

ESS Sample ID: S1220B1

Date Sampled: N/A

Date Extracted: 12/20/93

Date Analyzed: 1/17/94

Dilution Factor: 1x

Parameter	Result (ug/Kg)	MRL
Nitrobenzene	ND	330
N-nitrosodiphenylamine	ND	330
N-nitrosodi-n-propylamine	ND	330
Bis(2-ethylhexyl) phthalate	ND	330
Di-n-butylphthalate	ND	330
Di-n-octylphthalate	ND	330
Diethyl phthalate	ND	330
Dimethyl phthalate	ND	330
Benzo(a) anthracene	ND	330
Benzo(a) pyrene	ND	330
Benzo(b) fluoranthene	ND	330
Benzo(k) fluoranthene	ND	330
Chrysene	ND	330
Acenaphthene	ND	330
Anthracene	ND	330
Benzo(ghi) perylene	ND	330
Fluorene	ND	330
Phenanthrene	ND	330
Dibenzo(a,h) anthracene	ND	330
Indeno(1,2,3-cd) pyrene	ND	330
Pyrene	ND	330
Hexachloroethane	ND	330
4-Bromophenyl-phenylether	ND	330
Benzyl Alcohol	ND	330
Benzoic Acid	ND	1,650
Bis(2-Chloroethoxy) ethane	ND	330
4-Chloroaniline	ND	330
2-Methylnaphthalene	ND	330
2-Nitroaniline	ND	330
3-Nitroaniline	ND	1,650
Dibenzofuran	ND	330
4-Nitroaniline	ND	330
Butylbenzylphthalate	ND	1,650
		330

N/A = Not Applicable

ND = Not Detected above Method Reporting Limit (MRL)

Approved by: 

133

Date: 2/2/94

Environmental Science Services

0043 



In Response To The Future

# CERTIFICATE OF ANALYSIS

## VOA SOIL SURROGATE RECOVERY

Client: RIDEM

Client  
Project ID: 12/14 Sampling

Date Sample Analyzed: 12/27/93

ESS  
Project ID: 934148

SAMPLE ID	1,2 DICHLOROETHANE-D4 (70-121%)*	TOLUENE-D8 (81-117%)*	BFB (74-121%)*
V1227B1	105%	98%	106%
934148-01	112	113	103
934148-02	103	116	88
934148-03	112	106	98
934148-04	99	110	95
934148-05	100	110	98
934148-06	115	106	92

\* Acceptance criteria

Approved by: 

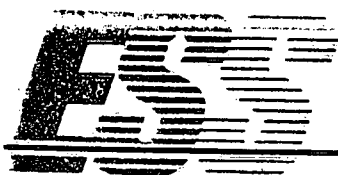
134

Date: 20 Jan 94

Environmental Science Services

0050

52



In Response To The Future

# CERTIFICATE OF ANALYSIS

## VOLATILE ORGANICS Method 8260

Client: RIDEM

Client Project ID: 12/14 Sampling

Client Sample ID: Method Blank

Date Sampled: N/A

Date Analyzed: 12/27/93

ESS Project ID: 934148

ESS Sample ID: V1227B1

Dilution Factor: 1x

Units: ug/Kg

Parameter	Result	MRL
Chloromethane	ND	10
Vinyl Chloride	ND	10
Bromomethane	ND	10
Chloroethane	ND	10
Trichlorofluoromethane	ND	5
1,1-Dichloroethene	ND	5
Acetone	ND	50
Carbon Disulfide	ND	5
Methylene Chloride	ND	5
Methyl tert-Butyl Ether	ND	10
Trans-1,2-Dichloroethene	ND	5
1,1-Dichloroethane	ND	5
Cis-1,2-Dichloroethene	ND	5
Methyl Ethyl Ketone	ND	50
Chloroform	ND	5
1,1,1-Trichloroethane	ND	5
Carbon Tetrachloride	ND	5
Benzene	ND	5
1,2-Dichloroethane	ND	5
Trichloroethene	ND	5
1,2-Dichloropropane	ND	5
Bromodichloromethane	ND	5
Cis-1,3-Dichloropropene	ND	5
Methyl Isobutyl Ketone	ND	50
Toluene	ND	5
Trans-1,3-Dichloropropene	ND	5
1,1,2-Trichloroethane	ND	5
Tetrachloroethene	ND	5
2-Hexanone	ND	50
Dibromochloromethane	ND	5
Chlorobenzene	ND	5
Ethylbenzene	ND	5
Xylenes (Total)	ND	10
Styrene	ND	5
Bromoform	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Dichlorobenzene (Total)	ND	10

N/A = Not Applicable

ND = Not Detected above Method Reporting Limit (MRL)

Approved by:

Environmental Science Services

135

Date: 2/10/94

0051



In Response To The Future

# CERTIFICATE OF ANALYSIS

## VOA SOIL SURROGATE RECOVERY

Client: RIDEM

Client  
Project ID: 12/145 Sampling

Date Sample Analyzed: 12/28/93

ESS  
Project ID: 934148

SAMPLE ID	1,2 DICHLOROETHANE-D4 (70-121%) *	TOLUENE-D8 (81-117%) *	BFB (74-121%) *
V1228B1	103%	94%	107%
934148-07	90	100	88
934148-08	100	104	83

\* Acceptance criteria

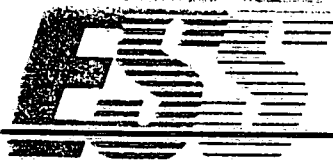
Approved by: 

Environmental Science Services

136

Date: 

0052



In Response To The Future

# CERTIFICATE OF ANALYSIS

## VOLATILE ORGANICS Method 8260

Client: RIDEM

Client Project ID: 12/14 Sampling

Client Sample ID: Method Blank

Date Sampled: N/A

Date Analyzed: 12/28/93

ESS Project ID: 934148

ESS Sample ID: V1228B1

Dilution Factor: 1x

Units: ug/Kg

Parameter	Result	MRL
Chloromethane	ND	10
Vinyl Chloride	ND	10
Bromomethane	ND	10
Chloroethane	ND	10
Trichlorofluoromethane	ND	5
1,1-Dichloroethene	ND	5
Acetone	ND	50
Carbon Disulfide	ND	5
Methylene Chloride	12	5
Methyl tert-Butyl Ether	ND	10
Trans-1,2-Dichloroethene	ND	5
1,1-Dichloroethane	ND	5
Cis-1,2-Dichloroethene	ND	5
Methyl Ethyl Ketone	ND	50
Chloroform	ND	5
1,1,1-Trichloroethane	ND	5
Carbon Tetrachloride	ND	5
Benzene	ND	5
1,2-Dichloroethane	ND	5
Trichloroethene	ND	5
1,2-Dichloropropane	ND	5
Bromodichloromethane	ND	5
Cis-1,3-Dichloropropene	ND	5
Methyl Isobutyl Ketone	ND	50
Toluene	ND	5
Trans-1,3-Dichloropropene	ND	5
1,1,2-Trichloroethane	ND	5
Tetrachloroethene	ND	5
2-Hexanone	ND	50
Dibromochloromethane	ND	5
Chlorobenzene	ND	5
Ethylbenzene	ND	5
Xylenes (Total)	ND	10
Styrene	ND	5
Bromoform	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Dichlorobenzene (Total)	ND	10

N/A = Not Applicable

ND = Not Detected above Method Reporting Limit (MRL)



In Response To The Future

# CERTIFICATE OF ANALYSIS

## VOA AQUEOUS SURROGATE RECOVERY

Client: RIDEM

Client  
Project ID: 12/14 Sampling

Date Sample Analyzed: 12/27/93

ESS  
Project ID: 934148

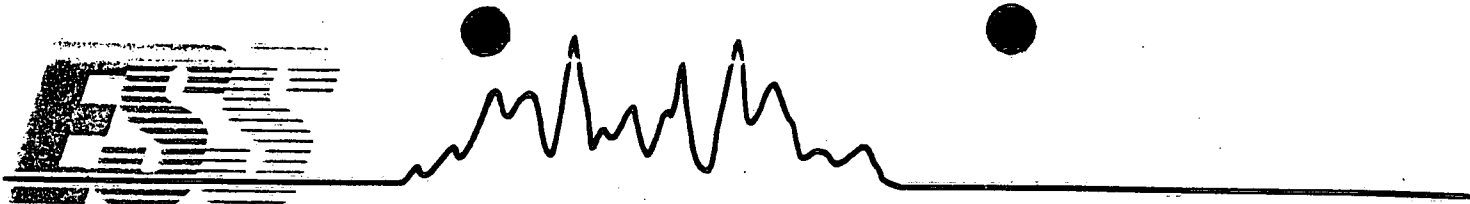
SAMPLE ID	1,2 DICHLOROETHANE-D4 (70-121%)*	TOLUENE-D8 (81-117%)*	BFB (74-121%)*
V1227B1	105%	98%	106%
934148-09	101	105	105
934148-10	113	105	107

\* Acceptance criteria

Approved by: 

Environmental Science Services

Date: 2/2/05



In Response To The Future

# CERTIFICATE OF ANALYSIS

## VOLATILE ORGANICS Method 8260

Client: RIDEM

Client Project ID: 12/14 Sampling

Client Sample ID: Method Blank

Date Sampled: N/A

Date Analyzed: 12/27/93

ESS Project ID: 934148

ESS Sample ID: V1227B1

Dilution Factor: 1x

Units: ug/L

Parameter	Result	MRL
Chloromethane	ND	10
Vinyl Chloride	ND	10
Bromomethane	ND	10
Chloroethane	ND	10
Trichlorofluoromethane	ND	5
1,1-Dichloroethene	ND	5
Acetone	ND	50
Carbon Disulfide	ND	5
Methylene Chloride	ND	5
Methyl tert-Butyl Ether	ND	10
Trans-1,2-Dichloroethene	ND	5
1,1-Dichloroethane	ND	5
Cis-1,2-Dichloroethene	ND	5
Methyl Ethyl Ketone	ND	50
Chloroform	ND	5
1,1,1-Trichloroethane	ND	5
Carbon Tetrachloride	ND	5
Benzene	ND	5
1,2-Dichloroethane	ND	5
Trichloroethene	ND	5
1,2-Dichloropropane	ND	5
Bromodichloromethane	ND	5
Cis-1,3-Dichloropropene	ND	5
Methyl Isobutyl Ketone	ND	50
Toluene	ND	5
Trans-1,3-Dichloropropene	ND	5
1,1,2-Trichloroethane	ND	5
Tetrachloroethene	ND	5
2-Hexanone	ND	50
Dibromochloromethane	ND	5
Chlorobenzene	ND	5
Ethylbenzene	ND	5
Xylenes (Total)	ND	10
Styrene	ND	5
Bromoform	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Dichlorobenzene (Total)	ND	10

N/A = Not Applicable

ND = Not Detected above Method Reporting Limit (MRL)



In Response To The Future

# CERTIFICATE OF ANALYSIS

## TOTAL METALS Method Blank

Client: RIDEM

ESS Project ID: 934148

Client Project ID: 12/14 Sampling

ESS Sample ID: 1227LCB

Client Sample ID: Method Blank

Date Reported: 1/19/94

Target Analyte	Result (mg/Kg)	MRL (mg/Kg)
Arsenic	ND	1
Barium	ND	20
Cadmium	ND	1
Chromium	ND	5
Lead	ND	10
Mercury	ND	0.5
Selenium	ND	1
Silver	ND	1

Control Limits are twice Method Reporting Limit (MRL)

ND = Not Detected above MRL

Approved by: 

Environmental Science Services

Date: 2/1/94

0056



In Response To The Future

## CERTIFICATE OF ANALYSIS

### Laboratory Control Sample

Client: RIDEM

ESS Project ID: 934148

Client Project ID: 12/14 Sampling

ESS Sample ID: 1227MB

Client Sample ID: Laboratory Control Sample Date Reported: 1/19/94

Matrix: Soil

Target Analyte	% Recovery	Control Limits
Arsenic	103	70 - 130%
Barium	105	70 - 130
Cadmium	94	70 - 130
Chromium	108	70 - 130
Lead	101	70 - 130
Mercury	112	70 - 130
Selenium	90	70 - 130
Silver	90	70 - 130

Approved by:

Environmental Science Services

Date:

20 Jan 1994

0057

SD-9 through SD-15  
**QUALITY CONTROL SECTION**



In Response To The Future

## CERTIFICATE OF ANALYSIS

### VOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Client: RIDEM

Client Project ID: 12/15 Sampling

ESS Project ID: 934170

Client Sample ID: SD-11 MS/MSD

ESS Sample ID: 934170-03 MS/MSD

Date Sampled: 12/15/93

Date Analyzed: 12/29/93

Compound	Sample Concentration (ug/Kg)	Spike Added	MS Concentration	MS % Rec#	QC Limits REC
1,1-Dichloroethene	ND	50	53	106	59-172
Trichloroethene	ND	50	50	100	62-137
Benzene	ND	50	62	124	66-142
Toluene	ND	50	65	130	59-139
Chlorobenzene	ND	50	62	124	60-133

Compound	Spike Added	MSD Concentration	MSD % Rec#	% RPD#	QC Limits RPD	REC
1,1-Dichloroethene	50	66	132	22	22	59-172
Trichloroethene	50	47	94	6	24	62-137
Benzene	50	59	118	5	21	66-142
Toluene	50	60	120	8	21	59-139
Chlorobenzene	50	58	116	7	21	60-133

# Column to be used to flag recovery and RPD values with an asterisk  
\* Values outside of QC Limits

Approved by: 

Environmental Science Services

143

Date: 20 Jan 94



In Response To The Future

## CERTIFICATE OF ANALYSIS

### VOLATILE ORGANICS Method 8260

Client: RIDEM

Client Project ID: 12/15 Sampling

Client Sample ID: SD-11 Matrix Spike

Date Sampled: 12/15/93

Date Analyzed: 12/29/93

ESS Project ID: 934170

ESS Sample ID: 934170-03MS

Dilution Factor: 1x

Units: ug/Kg

Parameter	Result	MRL
Chloromethane	ND	10
Vinyl Chloride	ND	10
Bromomethane	ND	10
Chloroethane	ND	10
Trichlorofluoromethane	ND	5
1,1-Dichloroethene	53*	5
Acetone	60	50
Carbon Disulfide	ND	5
Methylene Chloride	8	5
Methyl tert-Butyl Ether	ND	10
Trans-1,2-Dichloroethene	ND	5
1,1-Dichloroethane	ND	5
Cis-1,2-Dichloroethene	ND	5
Methyl Ethyl Ketone	ND	50
Chloroform	ND	5
1,1,1-Trichloroethane	ND	5
Carbon Tetrachloride	ND	5
Benzene	62*	5
1,2-Dichloroethane	ND	5
Trichloroethene	50*	5
1,2-Dichloropropane	ND	5
Bromodichloromethane	ND	5
Cis-1,3-Dichloropropene	ND	5
Methyl Isobutyl Ketone	ND	50
Toluene	65*	5
Trans-1,3-Dichloropropene	ND	5
1,1,2-Trichloroethane	ND	5
Tetrachloroethene	ND	5
2-Hexanone	ND	50
Dibromochloromethane	ND	5
Chlorobenzene	62*	5
Ethylbenzene	ND	5
Xylenes (Total)	ND	10
Styrene	ND	5
Bromoform	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Dichlorobenzene (Total)	ND	10

\* Matrix Spike compound

ND = Not Detected above Method Reporting Limit (MRL)



In Response To The Future

# CERTIFICATE OF ANALYSIS

## VOLATILE ORGANICS Method 8260

Client: RIDEM

Client Project ID: 12/15 Sampling

ESS Project ID: 934170

Client Sample ID: SD-11 Matrix Spike Dup.

ESS Sample ID: 934170-03MSD

Date Sampled: 12/15/93

Dilution Factor: 1x

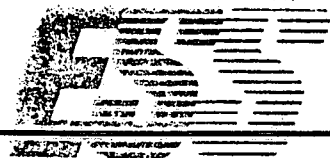
Date Analyzed: 12/29/93

Units: ug/Kg

Parameter	Result	MRL
Chloromethane	ND	10
Vinyl Chloride	ND	10
Bromomethane	ND	10
Chloroethane	ND	10
Trichlorofluoromethane	ND	5
1,1-Dichloroethene	66*	5
Acetone	64	50
Carbon Disulfide	ND	5
Methylene Chloride	8	5
Methyl tert-Butyl Ether	ND	10
Trans-1,2-Dichloroethene	ND	5
1,1-Dichloroethane	ND	5
Cis-1,2-Dichloroethene	ND	5
Methyl Ethyl Ketone	ND	50
Chloroform	ND	5
1,1,1-Trichloroethane	ND	5
Carbon Tetrachloride	ND	5
Benzene	59*	5
1,2-Dichloroethane	ND	5
Trichloroethene	47*	5
1,2-Dichloropropane	ND	5
Bromodichloromethane	ND	5
Cis-1,3-Dichloropropene	ND	5
Methyl Isobutyl Ketone	ND	50
Toluene	60*	5
Trans-1,3-Dichloropropene	ND	5
1,1,2-Trichloroethane	ND	5
Tetrachloroethene	ND	5
2-Hexanone	ND	50
Dibromochloromethane	ND	5
Chlorobenzene	58*	5
Ethylbenzene	ND	5
Xylenes (Total)	ND	10
Styrene	ND	5
Bromoform	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Dichlorobenzene (Total)	ND	10

\* Matrix Spike compound

ND = Not Detected above Method Reporting Limit (MRL)



In Response To The Future

## CERTIFICATE OF ANALYSIS

### PCB SURROGATE RECOVERY

Client: RIDEM

Client  
Project ID: 12/15 Sampling

Date Sample Analyzed: 12/22/93

ESS  
Project ID: 934170

SAMPLE ID	2,4,5,6 TETRACHLORO-M- XYLENE (50-150%) *	DECACHLOROBIPHENYL (50-150%) *
P1221B1	104%	110%
934170-01	102	154#
934170-02	96	118
934170-03	105	125
934170-04	108	127
934170-05	102	116
934170-06	99	117
934170-07	102	122

\* Advisory Limits

# Surrogate Recovery is outside Advisory Limits.

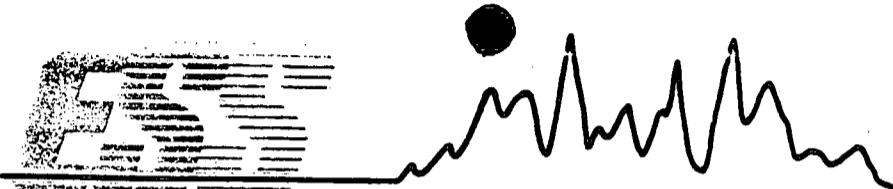
Approved by: 

Environmental Science Services

Date: 2/1/94

146

0042



CERTIFICATE OF ANALYSIS

POLYCHLORINATED BIPHENYLS  
Method 8081

In Response To The Future

Client: RIDEM

Client Project ID: 12/15 Sampling

ESS Project ID: 934170

Client Sample ID: Method Blank

ESS Sample ID: P1221B1

Date Sample Received: N/A

Date Reported: 1/19/94

Parameter	Result (mg/Kg)	MRL
Arochlor 1016	ND	1
Arochlor 1221	ND	1
Arochlor 1232	ND	1
Arochlor 1242	ND	1
Arochlor 1248	ND	1
Arochlor 1254	ND	1
Arochlor 1260	ND	1

N/A = Not Applicable

ND = Not Detected above Method Reporting Limit (MRL)

Approved by: 

Environmental Science Services

147

Date: 20 Jan 94

0000



In Response To The Future

## CERTIFICATE OF ANALYSIS

### ACID SURROGATE RECOVERY

Client: RIDEM

Client  
Project ID: 12/15 Sampling

Date Sample Analyzed: 12/22/93

ESS  
Project ID: 934170

SAMPLE ID	(2CP) (33-110) *	(PHL) (10-110%) *	(2FP) (21-110%) *	(TBP) (10-123%) *
S1221B1	71%	64%	65%	109%

\* QC Limits

2CP = 2-CHLOROPHENOL-D4

PHL = PHENOL-D5

2FP = 2-FLUOROPHENOL

TBP = 2,4,6 TRIBROMOPHENOL

Approved by: 

Environmental Science Services

Date: 28 Jan 94

148

0001

SR



In Response To The Future

## CERTIFICATE OF ANALYSIS

### BASE-NEUTRAL SURROGATE RECOVERY

Client: RIDEM

Client  
Project ID: 12/15 Sampling

Date Sample Analyzed: 12/22/93

ESS  
Project ID: 934170

SAMPLE ID	(DCB) (16-110) *	(NBZ) (35-114%) *	(FBP) (43-116%) *	(TPH) (33-141%) *
S1221B1	80%	86%	91%	80%

\* QC Limits

DCB = 1,2-DICHLOROBENZENE-D4

NBZ = NITROBENZENE-D5

FBP = 2-FLUOROBIPHENYL

TPH = P-TERPHENYL-D14

149

Approved by: 

Date: 20/12/94

Environmental Science Services

0045



In Response To The Future

## CERTIFICATE OF ANALYSIS

### ACID SURROGATE RECOVERY

Client: RIDEM

Client  
Project ID: 12/15 Sampling

Date Sample Analyzed: 1/15/94

ESS  
Project ID: 934170

SAMPLE ID	(2CP) (33-110) *	(PHL) (10-110%) *	(2FP) (21-110%) *	(TBP) (10-123%) *
934170-01	89%	68%	84%	94%
934170-02	92	70	87	82
934170-03	97	75	93	84
934170-04	90	71	87	72
934170-05	93	71	91	78
934170-06	94	73	91	84
934170-07	88	69	86	90

\* QC Limits

2CP = 2-CHLOROPHENOL-D4  
PHL = PHENOL-D5  
2FP = 2-FLUOROPHENOL  
TBP = 2,4,6 TRIBROMOPHENOL

160

Approved by: 

Date: 20 Jan 94

Environmental Science Services

0046



In Response To The Future

## CERTIFICATE OF ANALYSIS

### BASE-NEUTRAL SURROGATE RECOVERY

Client: RIDEM

Client  
Project ID: 12/15 Sampling

Date Sample Analyzed: 1/15/94

ESS  
Project ID: 934170

SAMPLE ID	(DCB) (16-110) *	(NBZ) (35-114%) *	(FBP) (43-116%) *	(TPH) (33-141%) *
934170-01	99%	110%	110%	208%#
934170-02	103	114	113	258#
934170-03	110	117#	118#	320#
934170-04	102	111	109	286#
934170-05	106	116#	110	230#
934170-06	106	117#	113	269#
934170-07	102	111	113	260#

\* QC Limits

# Surrogate Recovery is outside Acceptance criteria.


DCB = 1,2-DICHLOROBENZENE-D4

NBZ = NITROBENZENE-D5

FBP = 2-FLUOROBIPHENYL

TPH = P-TERPHENYL-D14

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Approved by:   
Environmental Science Services

Date:

20 Jan 94

0047



In Response To The Future

# CERTIFICATE OF ANALYSIS

## BASE-NEUTRAL & ACID EXTRACTABLES

EPA 8270 (Page 1 of 2)

Client: RIDEM

Client Project ID: 12/15 Sampling

ESS Project ID: 934170

Client Sample ID: Method Blank

ESS Sample ID: S1221B1

Date Sampled: N/A

Date Extracted: 12/21/93

Date Analyzed: 12/22/93

Dilution Factor: 1x

Parameter	Result (ug/Kg)	MRL
2-Chlorophenol	ND	330
2-Nitrophenol	ND	330
Phenol	ND	330
2,4-Dimethylphenol	ND	330
2,4-Dichlorophenol	ND	330
2,4-Dinitrophenol	ND	1,650
Pentachlorophenol	ND	1,650
4-Nitrophenol	ND	1,650
2,4,6-Trichlorophenol	ND	330
2,4,5-Trichlorophenol	ND	1,650
2-Methylphenol	ND	330
4-Methylphenol	ND	330
4-Chloro-3-Methylphenol	ND	330
4,6-Dinitro-2-Methylphenol	ND	1,650
Acenaphthylene	ND	330
1,2,4-Trichlorobenzene	ND	330
Hexachlorobenzene	ND	330
Bis(2-chloroethyl) ether	ND	330
2-Chloronaphthalene	ND	330
1,2-Dichlorobenzene	ND	330
1,3-Dichlorobenzene	ND	330
1,4-Dichlorobenzene	ND	330
3,3-Dichlorobenzidine	ND	660
2,4-Dinitrotoluene	ND	330
2,6-Dinitrotoluene	ND	330
Fluoranthene	ND	330
4-Chlorophenyl phenyl ether	ND	330
Bis(2-chloroisopropyl) ether	ND	330
Bis(2-chloroethoxy) methane	ND	330
Hexachlorobutadiene	ND	330
Hexachlorocyclopentadiene	ND	330
Isophorone	ND	330
Naphthalene	ND	330

N/A = Not Applicable

ND = Not Detected above Method Reporting Limit (MRL)

Approved by: 

152

Date: 



In Response To The Future

# CERTIFICATE OF ANALYSIS

BASE-NEUTRAL & ACID EXTRACTABLES

EPA 8270 (Page 2 of 2)

Client: RIDEM

Client Project ID: 12/15 Sampling

ESS Project ID: 934170

Client Sample ID: Method Blank

ESS Sample ID: S1221B1

Date Sampled: N/A

Date Extracted: 12/21/93

Date Analyzed: 12/22/93

Dilution Factor: 1x

Parameter	Result (ug/Kg)	MRL
Nitrobenzene	ND	330
N-nitrosodiphenylamine	ND	330
N-nitrosodi-n-propylamine	ND	330
Bis(2-ethylhexyl)phthalate	ND	330
Di-n-butylphthalate	ND	330
Di-n-octylphthalate	ND	330
Diethyl phthalate	ND	330
Dimethyl phthalate	ND	330
Benzo(a)anthracene	ND	330
Benzo(a)pyrene	ND	330
Benzo(b)fluoranthene	ND	330
Benzo(k)fluoranthene	ND	330
Chrysene	ND	330
Acenaphthene	ND	330
Anthracene	ND	330
Benzo(ghi)perylene	ND	330
Fluorene	ND	330
Phenanthrene	ND	330
Dibenzo(a,h)anthracene	ND	330
Indeno(1,2,3-cd)pyrene	ND	330
Pyrene	ND	330
Hexachloroethane	ND	330
4-Bromophenyl-phenylether	ND	330
Benzyl Alcohol	ND	330
Benzoic Acid	ND	1,650
Bis(2-Chloroethoxy) ethane	ND	330
4-Chloroaniline	ND	330
2-Methylnaphthalene	ND	330
2-Nitroaniline	ND	1,650
3-Nitroaniline	ND	330
Dibenzofuran	ND	330
4-Nitroaniline	ND	1,650
Butylbenzylphthalate	ND	330

N/A = Not Applicable

ND = Not Detected above Method Reporting Limit (MRL)

Approved by: 

153

Date: 



In Response To The Future

## CERTIFICATE OF ANALYSIS

### VOA SOIL SURROGATE RECOVERY

Client: RIDEM

Client  
Project ID: 12/15 Sampling

Date Sample Analyzed: 12/29/93

ESS  
Project ID: 934170

SAMPLE ID	1,2 DICHLOROETHANE-D4 (70-121%)*	TOLUENE-D8 (81-117%)*	BFB (74-121%)*
V1229B1	95%	90%	95%
934170-01	98	93	91
934170-02	103	99	75
934170-03	104	90	88
934170-03MS	98	98	91
934170-03MSD	97	97	95
934170-04	108	100	85
934170-05	102	101	75
934170-06	105	93	89
934170-07	88	97	91

\* Acceptance criteria

Approved by:   
Environmental Science Services

154

Date: 2/2/94

0050

5A



In Response To The Future

# CERTIFICATE OF ANALYSIS

## VOLATILE ORGANICS Method 8260

Client: RIDEM

Client Project ID: 12/15 Sampling

Client Sample ID: Method Blank

Date Sampled: N/A

Date Analyzed: 12/29/93

ESS Project ID: 934170

ESS Sample ID: V1229B1

Dilution Factor: 1x

Units: ug/Kg

Parameter	Result	MRL
Chloromethane	ND	10
Vinyl Chloride	ND	10
Bromomethane	ND	10
Chloroethane	ND	10
Trichlorofluoromethane	ND	5
1,1-Dichloroethene	ND	5
Acetone	ND	50
Carbon Disulfide	ND	5
Methylene Chloride	ND	5
Methyl tert-Butyl Ether	ND	10
Trans-1,2-Dichloroethene	ND	5
1,1-Dichloroethane	ND	5
Cis-1,2-Dichloroethene	ND	5
Methyl Ethyl Ketone	ND	50
Chloroform	ND	5
1,1,1-Trichloroethane	ND	5
Carbon Tetrachloride	ND	5
Benzene	ND	5
1,2-Dichloroethane	ND	5
Trichloroethene	ND	5
1,2-Dichloropropane	ND	5
Bromodichloromethane	ND	5
Cis-1,3-Dichloropropene	ND	5
Methyl Isobutyl Ketone	ND	50
Toluene	ND	5
Trans-1,3-Dichloropropene	ND	5
1,1,2-Trichloroethane	ND	5
Tetrachloroethene	ND	5
2-Hexanone	ND	50
Dibromochloromethane	ND	5
Chlorobenzene	ND	5
Ethylbenzene	ND	5
Xylenes (Total)	ND	10
Styrene	ND	5
Bromoform	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Dichlorobenzene (Total)	ND	10

N/A = Not Applicable

ND = Not Detected above Method Reporting Limit (MRL)

Approved by:   
Environmental Science Services

155

Date: 2/29/94 0051



In Response To The Future

## CERTIFICATE OF ANALYSIS

### VOA AQUEOUS SURROGATE RECOVERY

Client: RIDEM

Client  
Project ID: 12/15 Sampling

Date Sample Analyzed: 12/28/93

ESS  
Project ID: 934170

SAMPLE ID	1,2 DICHLOROETHANE-D4 (70-121%) *	TOLUENE-D8 (81-117%) *	BFB (74-121%) *
V1228B1	79%	83%	91%
934170-08	77	80#	87
934170-09	79	78	89

\* Acceptance criteria

# Surrogate Recovery is outside Advisory Limits, two of three compounds must be within criteria.

Approved by: 

Environmental Science Services

156

Date: 2/29/94

0052



In Response To The Future

# CERTIFICATE OF ANALYSIS

## VOLATILE ORGANICS Method 8260

Client: RIDEM

Client Project ID: 12/15 Sampling

Client Sample ID: Method Blank

Date Sampled: N/A

Date Analyzed: 12/28/93

ESS Project ID: 934170

ESS Sample ID: V1228B1

Dilution Factor: 1x

Units: ug/L

Parameter	Result	MRL
Chloromethane	ND	10
Vinyl Chloride	ND	10
Bromomethane	ND	10
Chloroethane	ND	10
Trichlorofluoromethane	ND	5
1,1-Dichloroethene	ND	5
Acetone	ND	50
Carbon Disulfide	ND	5
Methylene Chloride	7	5
Methyl tert-Butyl Ether	ND	10
Trans-1,2-Dichloroethene	ND	5
1,1-Dichloroethane	ND	5
Cis-1,2-Dichloroethene	ND	5
Methyl Ethyl Ketone	ND	50
Chloroform	ND	5
1,1,1-Trichloroethane	ND	5
Carbon Tetrachloride	ND	5
Benzene	ND	5
1,2-Dichloroethane	ND	5
Trichloroethene	ND	5
1,2-Dichloropropane	ND	5
Bromodichloromethane	ND	5
Cis-1,3-Dichloropropene	ND	5
Methyl Isobutyl Ketone	ND	50
Toluene	ND	5
Trans-1,3-Dichloropropene	ND	5
1,1,2-Trichloroethane	ND	5
Tetrachloroethene	ND	5
2-Hexanone	ND	50
Dibromochloromethane	ND	5
Chlorobenzene	ND	5
Ethylbenzene	ND	5
Xylenes (Total)	ND	10
Styrene	ND	5
Bromoform	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Dichlorobenzene (Total)	ND	10

N/A = Not Applicable

ND = Not Detected above Method Reporting Limit (MRL)

Approved by:

Environmental Science Services

157

Date:

2/2/94

0053



In Response To The Future

## CERTIFICATE OF ANALYSIS

### TOTAL METALS Method Blank

Client: RIDEM

ESS Project ID: 934170

Client Project ID: 12/15 Sampling

ESS Sample ID: 1228LCB

Client Sample ID: Method Blank

Date Reported: 1/19/94

Target Analyte	Result (mg/Kg)	MRL (mg/Kg)
Arsenic	ND	1
Barium	ND	20
Cadmium	ND	1
Chromium	ND	5
Lead	ND	10
Mercury	ND	0.5
Selenium	ND	1
Silver	ND	1

Control Limits are twice Method Reporting Limit (MRL)

ND = Not Detected above MRL

Approved by:   
Environmental Science Services

158

Date: 2/1/94

0051 15



In Response To The Future

## CERTIFICATE OF ANALYSIS

### Laboratory Control Sample

Client: RIDEM

ESS Project ID: 934170

Client Project ID: 12/15 Sampling

ESS Sample ID: 1228MB

Client Sample ID: Laboratory Control Sample Date Reported: 1/19/94

Matrix: Soil

Target Analyte	% Recovery	Control Limits
Arsenic	98	70 - 130%
Barium	94	70 - 130
Cadmium	97	70 - 130
Chromium	108	70 - 130
Lead	95	70 - 130
Mercury	72	70 - 130
Selenium	94	70 - 130
Silver	93	70 - 130

Approved by: 

Environmental Science Services

159

Date: 20 Jan 94

0055

55

SD-16 through SD-18

**QUALITY CONTROL SECTION**

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In Response To The Request

## CERTIFICATE OF ANALYSIS

### PCB SURROGATE RECOVERY

Client: RIDEM

Client  
Project ID: 12/16 Sampling

Date Sample Analyzed: 12/22/93

ESS  
Project ID: 934191

SAMPLE ID	2,4,5,6 TETRACHLORO-M- XYLENE (50-150%) *	DECACHLOROBIPHENYL (50-150%) *
P1221B1	104%	110%
934191-01	90	407#
934191-02	84	492#
934191-03	94	241#

#### \* Advisory Limits

# Surrogate Recovery is outside Advisory Limits, due to sample matrix effects.

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Approved by: *[Signature]*

Date: 2/4/94

Environmental Science Services



In Response To The Future

## CERTIFICATE OF ANALYSIS

### POLYCHLORINATED BIPHENYLS Method 8081

Client: RIDEM

Client Project ID: 12/16 Sampling

ESS Project ID: 934191

Client Sample ID: Method Blank

ESS Sample ID: P1221B1

Date Sample Received: N/A

Date Reported: 1/31/94

Parameter	Result (mg/Kg)	MRL
Arochlor 1016	ND	1
Arochlor 1221	ND	1
Arochlor 1232	ND	1
Arochlor 1242	ND	1
Arochlor 1248	ND	1
Arochlor 1254	ND	1
Arochlor 1260	ND	1

N/A = Not Applicable

ND = Not Detected above Method Reporting Limit (MRL)

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Approved by:                     

Date: 2/4/94

Environmental Science Services

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In Response To The Future

## CERTIFICATE OF ANALYSIS

### ACID SURROGATE RECOVERY

Client: RIDEM

Client  
Project ID: 12/16 Sampling

Date Sample Analyzed: 12/22/93  
1/25/94

ESS  
Project ID: 934191

SAMPLE ID	(2CP) (33-110) *	(PHL) (10-110%) *	(2FP) (21-110%) *	(TBP) (10-123%) *
S1221B1	71%	64%	65%	109%
934191-01	105	77	100	104
934191-02	107	79	101	81
934191-03	104	88	111	94

#### \* QC Limits

Acceptance criteria: Three of four surrogates must be within QC Limits.

2CP = 2-CHLOROPHENOL-D4  
PHL = PHENOL-D5  
2FP = 2-FLUOROPHENOL  
TBP = 2,4,6 TRIBROMOPHENOL

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Approved by: [Signature]

Date: 2/4/94

Environmental Science Services



In Response To The Future

## CERTIFICATE OF ANALYSIS

### BASE-NEUTRAL SURROGATE RECOVERY

Client: RIDEM

Client  
Project ID: 12/16 Sampling

Date Sample Analyzed: 12/22/93  
1/25/94

ESS  
Project ID: 934191

SAMPLE ID	(DCB) (16-110) *	(NBZ) (35-114%) *	(FBP) (43-116%) *	(TPH) (33-141%) *
S1221B1	80%	86%	91%	80%
934191-01	88	74	93	112
934191-02	89	77	94	81
934191-03	73	72	77	109

#### \* QC Limits

Acceptance criteria: Three of four surrogates must be within QC Limits.

DCB = 1,2-DICHLOROBENZENE-D4

NBZ = NITROBENZENE-D5

FBP = 2-FLUOROBIPHENYL

TPH = P-TERPHENYL-D14

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Approved by: gls Mll

Date: 2/4/94

Environmental Science Services



In Response To The Future

# CERTIFICATE OF ANALYSIS

BASE-NEUTRAL & ACID EXTRACTABLES

EPA 8270 (Page 1 of 2)

Client: RIDEM

Client Project ID: 12/16 Sampling

ESS Project ID: 934191

Client Sample ID: Method Blank

ESS Sample ID: S1221B1

Date Sampled: N/A

Date Extracted: 12/21/93

Date Analyzed: 12/22/93

Dilution Factor: 1x

Parameter	Result (ug/Kg)	MRL
2-Chlorophenol	ND	330
2-Nitrophenol	ND	330
Phenol	ND	330
2,4-Dimethylphenol	ND	330
2,4-Dichlorophenol	ND	330
2,4-Dinitrophenol	ND	1,650
Pentachlorophenol	ND	1,650
4-Nitrophenol	ND	1,650
2,4,6-Trichlorophenol	ND	330
2,4,5-Trichlorophenol	ND	1,650
2-Methylphenol	ND	330
4-Methylphenol	ND	330
4-Chloro-3-Methylphenol	ND	330
4,6-Dinitro-2-Methylphenol	ND	1,650
Acenaphthylene	ND	330
1,2,4-Trichlorobenzene	ND	330
Hexachlorobenzene	ND	330
Bis(2-chloroethyl) ether	ND	330
2-Chloronaphthalene	ND	330
1,2-Dichlorobenzene	ND	330
1,3-Dichlorobenzene	ND	330
1,4-Dichlorobenzene	ND	330
3,3-Dichlorobenzidine	ND	660
2,4-Dinitrotoluene	ND	330
2,6-Dinitrotoluene	ND	330
Fluoranthene	ND	330
4-Chlorophenyl phenyl ether	ND	330
Bis(2-chloroisopropyl) ether	ND	330
Bis(2-chloroethoxy) methane	ND	330
Hexachlorobutadiene	ND	330
Hexachlorocyclopentadiene	ND	330
Isophorone	ND	330
Naphthalene	ND	330

N/A = Not Applicable

ND = Not Detected above Method Reporting Limit (MRL)

Approved by: [Signature]

165

Date: 2/4/94



In Response To The Future

# CERTIFICATE OF ANALYSIS

BASE-NEUTRAL & ACID EXTRACTABLES

EPA 8270 (Page 2 of 2)

Client: RIDEM

Client Project ID: 12/16 Sampling

ESS Project ID: 934191

Client Sample ID: Method Blank

ESS Sample ID: S1221B1

Date Sampled: N/A

Date Extracted: 12/21/93

Date Analyzed: 12/22/93

Dilution Factor: 1x

Parameter	Result (ug/Kg)	MRL
Nitrobenzene	ND	330
N-nitrosodiphenylamine	ND	330
N-nitrosodi-n-propylamine	ND	330
Bis(2-ethylhexyl)phthalate	ND	330
Di-n-butylphthalate	ND	330
Di-n-octylphthalate	ND	330
Diethyl phthalate	ND	330
Dimethyl phthalate	ND	330
Benzo(a)anthracene	ND	330
Benzo(a)pyrene	ND	330
Benzo(b)fluoranthene	ND	330
Benzo(k)fluoranthene	ND	330
Chrysene	ND	330
Acenaphthene	ND	330
Anthracene	ND	330
Benzo(ghi)perylene	ND	330
Fluorene	ND	330
Phenanthrene	ND	330
Dibenzo(a,h)anthracene	ND	330
Indeno(1,2,3-cd)pyrene	ND	330
Pyrene	ND	330
Hexachloroethane	ND	330
4-Bromophenyl-phenylether	ND	330
Benzyl Alcohol	ND	330
Benzoic Acid	ND	1,650
Bis(2-Chloroethoxy) ethane	ND	330
4-Chloroaniline	ND	330
2-Methylnaphthalene	ND	330
2-Nitroaniline	ND	1,650
3-Nitroaniline	ND	330
Dibenzofuran	ND	330
4-Nitroaniline	ND	1,650
Butylbenzylphthalate	ND	330

N/A = Not Applicable

ND = Not Detected above Method Reporting Limit (MRL)

Approved by: [Signature]

166

Date: 2/4/94



Environmental Science Services

# CERTIFICATE OF ANALYSIS

## VOA SOIL SURROGATE RECOVERY

Client: RIDEM

Client  
Project ID: 12/16 Sampling

Date Sample Analyzed: 12/29/93

ESS  
Project ID: 934191

SAMPLE ID	1,2 DICHLOROETHANE-D4 (70-121%)*	TOLUENE-D8 (81-117%)*	BFB (74-121%)*
V1229B1	95%	90%	95%
934191-01	95	100	89
934191-02	104	108	111
934191-03	108	97	108

\* Acceptance criteria

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Approved by: [Signature]

Date: 2/4/94

Environmental Science Services



16 Range and 7.00 to 7.00

# CERTIFICATE OF ANALYSIS

## VOLATILE ORGANICS Method 8260

Client: RIDEM

Client Project ID: 12/16 Sampling

Client Sample ID: Method Blank

Date Sampled: N/A

Date Analyzed: 12/29/93

ESS Project ID: 934191

ESS Sample ID: V1229B1

Dilution Factor: 1x

Units: ug/Kg

Parameter	Result	MRL
Chloromethane	ND	10
Vinyl Chloride	ND	10
Bromomethane	ND	10
Chloroethane	ND	10
Trichlorofluoromethane	ND	5
1,1-Dichloroethene	ND	5
Acetone	ND	50
Carbon Disulfide	ND	5
Methylene Chloride	ND	5
Methyl tert-Butyl Ether	ND	10
Trans-1,2-Dichloroethene	ND	5
1,1-Dichloroethane	ND	5
Cis-1,2-Dichloroethene	ND	5
Methyl Ethyl Ketone	ND	50
Chloroform	ND	5
1,1,1-Trichloroethane	ND	5
Carbon Tetrachloride	ND	5
Benzene	ND	5
1,2-Dichloroethane	ND	5
Trichloroethene	ND	5
1,2-Dichloropropane	ND	5
Bromodichloromethane	ND	5
Cis-1,3-Dichloropropene	ND	5
Methyl Isobutyl Ketone	ND	50
Toluene	ND	5
Trans-1,3-Dichloropropene	ND	5
1,1,2-Trichloroethane	ND	5
Tetrachloroethene	ND	5
2-Hexanone	ND	50
Dibromochloromethane	ND	5
Chlorobenzene	ND	5
Ethylbenzene	ND	5
Xylenes (Total)	ND	10
Styrene	ND	5
Bromoform	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Dichlorobenzene (Total)	ND	10

N/A = Not Applicable

ND = Not Detected above Method Reporting Limit (MRL)

Approved by:                       
Environmental Science Services

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Date: 2/4/94



In Response To The Future

## CERTIFICATE OF ANALYSIS

### VOA AQUEOUS SURROGATE RECOVERY

Client: RIDEM

Client

Project ID: 12/16 Sampling

Date Sample Analyzed: 12/29/93

ESS

Project ID: 934191

SAMPLE ID	1,2 DICHLOROETHANE-D4 (70-121%)*	TOLUENE-D8 (81-117%)*	BFB (74-121%)*
V1229B1	95%	90%	95%
934191-04	99	87	98
934191-05	91	88	98

\* Acceptance criteria

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Approved by: [Signature]

Date: 2/4/94

Environmental Science Services



In Response To The Future

# CERTIFICATE OF ANALYSIS

## VOLATILE ORGANICS Method 8260

Client: RIDEM

Client Project ID: 12/16 Sampling

Client Sample ID: Method Blank

Date Sampled: N/A

Date Analyzed: 12/29/93

ESS Project ID: 934191

ESS Sample ID: V1229B1

Dilution Factor: 1x

Units: ug/L

Parameter	Result	MRL
Chloromethane	ND	10
Vinyl Chloride	ND	10
Bromomethane	ND	10
Chloroethane	ND	10
Trichlorofluoromethane	ND	5
1,1-Dichloroethene	ND	5
Acetone	ND	50
Carbon Disulfide	ND	5
Methylene Chloride	ND	5
Methyl tert-Butyl Ether	ND	10
Trans-1,2-Dichloroethene	ND	5
1,1-Dichloroethane	ND	5
Cis-1,2-Dichloroethene	ND	5
Methyl Ethyl Ketone	ND	50
Chloroform	ND	5
1,1,1-Trichloroethane	ND	5
Carbon Tetrachloride	ND	5
Benzene	ND	5
1,2-Dichloroethane	ND	5
Trichloroethene	ND	5
1,2-Dichloropropane	ND	5
Bromodichloromethane	ND	5
Cis-1,3-Dichloropropene	ND	5
Methyl Isobutyl Ketone	ND	50
Toluene	ND	5
Trans-1,3-Dichloropropene	ND	5
1,1,2-Trichloroethane	ND	5
Tetrachloroethene	ND	5
2-Hexanone	ND	50
Dibromochloromethane	ND	5
Chlorobenzene	ND	5
Ethylbenzene	ND	5
Xylenes (Total)	ND	10
Styrene	ND	5
Bromoform	ND	5
1,1,2,2-Tetrachloroethane	ND	5
Dichlorobenzene (Total)	ND	10

N/A = Not Applicable

ND = Not Detected above Method Reporting Limit (MRL)

Approved by: [Signature]  
Environmental Science Services

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Date: 2/4/94